India—The Land and the People

Domestic Animals

HARBANS SINGH

NATIONAL BOOK TRUST, INDIA

DOMESTIC ANIMALS

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Harbans Singh
Revised by
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PREFACE TO THE FIRST EDITION

INDIA HAS a large livestock population of 343 86 million. Of this,. 228.97 million are cattle including 52.92 million buffaloes, 106.6 million sheep and goats, 5.0 million pigs, and 3.30 million horses, mules, donkeys, and camels. There are, in addition, 115.1 million poultry birds. India possesses nearly 11 per cent of the total livestock population of the world, which is estimated at 3,084.6 million, excluding poultry.

In India, for every 100 persons, there are 76 animals. If all these animals are made to stand in a single file they will go round the world, at the equator, about ten times and will almost cover the distance from the earth to the moon.

In case of cattle alone, India has nearly 21.5 per cent of the world's estimated 1,052.8 million bovine population. This is 13.1 per cent more than the combined bovine population of Europe and the Union of Soviet Socialist Republics and 52.2 per cent more than the total bovine population of North and Central America. In India, for almost every two persons, there is one cattle.

In spite of this large number of cattle, comprising about one-half of the world's buffaloes, one-fifth of the world's cattle, and one-sixth of the world's goat population, the milk production in India is only 20,933 thousand metric tons. This is nearly six per cent of the total world milk production. The average per capita daily consumption of milk in India is only 130 grams against 741 grams in Switzerland, 637 grams in New Zealand, 623 grams in the United States of America, and 509 grams in England. The world average is 303 grams.

The milk-yield capacity of the Indian cattle is very low as compared with that of the other countries. Against an average annual milk-yield per milking cow of 3,710 kilograms in Denmark, 3,250 kilograms in Switzerland, 3,280 kilograms in the United States of America, and 2,900 kilograms in the United Kingdom, the average yield of a cow in India is only 173 kilograms. Indian buffaloes yield a little more, the average being 491 kilograms. It has been estimated that in India, 94.3 per cent of the present-day milch cows yield less than one kilogram of milk daily and only 0.4 per cent yield over two kilograms in a day. In the case of buffaloes, 19.2 per cent yield less than one kilogram and 18.8 per cent yield over two kilograms daily.

There are 80.4 million working animals in India. The gross area available for cultivation is 152.3 million hectares. This means that a pair of bullocks is able to till only 3.8 hectares of land. One of the factors responsible for the present-day low yield of crops in India is obviously the poor working capacity of our draught animals.

The position of other species of livestock is equally dismal. India stands fifth in the world with regard to the population of sheep. But the major portion of the wool obtained in India is of low quality. It is hairy, coarse and is not suitable for making superior cloth. The annual yield of wool per sheep is also very low, the average being 700 grams, while in some of the exotic breeds, the fleece yield is 5 to 7 kilograms. As regards mutton, the average weight of sheep in India varies from 25 to 30 kilograms only. Exotic sheep weigh over three times as much.

As for poultry, India has a very small number of birds. There are only 25 chicken per 100 persons against 540 in Denmark, 373 in Canada, 286 in the United States of America, 179 in the United Kingdom, and 150-200 in other European countries. The number of birds per square kilometre in India is the second lowest in poultry population of the world. In the United States of America alone, there are 347.32 million laying hens, over three times the total poultry population in India. The annual laying capacity of an Indian hen is only about 60 eggs. This is less than half the world average of 130 per year. In the United States of America, the yearly average is 210 eggs per laying bird.

The present availability of eggs in India is only six per person, per year. This is against 295 in the United States of America, 282 in Canada, 281 in Irish Republic, and 249 in Western Germany. To achieve the target of one egg daily per head for half the population in India, it will be necessary to increase the number of laying hens in the country by 20 times, from the present 45 million to 900 million. It will also be necessary to increase the productive capacity of our laying birds to at least 100 eggs each per annum.

The annual per capita consumption of poultry meat in India is about 131 grams based on the total dressed weight of the different types of poultry available, as compared to 13.18 kilograms in the United States of America and 2.47 to 5.95 kilograms in European countries.

Basically, livestock-rearing in India is carried on under a variety of adverse climatic and environmental conditions. Animal husbandry centres round the small cultivator, to the large majority of whom livestock-raising is an occupation subsidiary to crop production. The cultivator is generally poor and resourceless. He lives on small fragmented holdings of less than two hectares of land maintaining two to three animals. In some of the European countries, the strength of an average herd is over 30 animals. Grazing during greater part of the year is poor except during the monsoon. Marketing facilities are extremely inadequate and almost the whole of the marketable surplus of milk produced in rural areas, where about 95 per cent of the cattle population is reared, is sold as *ghee*, which is the least remunerative of all milk products. Even that does not fetch the producer the full value because in the absence of an effective marketing organization and because of the smallness of the size of the herd, the moneyed middle man usually steps in to exploit the needs of the cattle owner and takes away most of his profits. The cultivator is thus deprived of all incentive to pay enough attention to the development of his livestock.

The main handicaps in the promotion and growth of livestock industry in India are not only the adverse climatic and other environmental factors, but such fundamental ones as the poor genetical potential of the large majority of the present-day livestock and the acute shortage of feeds and fodders. Whatever be the inherent qualities of the animals, they are not able to make these qualities effective in actual production unless they are properly and adequately fed. The shortage of feeds, at present, is probably the greatest limiting factor in improving the efficiency of Indian livestock. Against the estimated annual requirements of 40.28 million tons of concentrate feeds and 932 million tons of roughages, the actual availability is only 13.76 million tons of concentrates and 768 million tons of roughages, including green grass available as grazing. The area available under permanent meadows and pastures per unit of livestock in India is only 0.96 hectare as compared to 14.59 in Australia, 3.80 in the U.S.S.R., 2.64 in the United States of America, and 2.51 in Mexico. At present, less than four per cent of the total cropped area under food and non-food crops in the country is put under fodder crops, which is very low and inadequate for feeding the large animal population.

The livestock in India, in spite of its enormous number, makes a very meagre contribution to the national economy of the country. Livestock contributed 7.2 per cent of the total national income of India. Of the total income from animal husbandry, cattle contribute over 86 per cent. The total value of livestock products in 1959-60, at current prices, has been estimated at Rs 12,266.1 million. Out of this, milk and milk products contribute Rs 7,983.6 million, meat Rs 926.4 million, hides, and skins Rs 373.3 million, poultry and eggs Rs 298.3 million, wool and hair Rs 144.5 million, and other products Rs 257.9 million. The value of livestock as a means of raising the level of fertility of the soil and thus increasing the output of crops, under widely varying climatic and soil conditions, is difficult to assess. It has, however, been roughly valued at Rs 2,282.2 million. The contribution of animals in the form of draught power is estimated at about Rs 4,000 million.

In India, livestock contributes only 14.2 per cent of the net income from agriculture. In view of the enormity of the livestock population of the country, this contribution is very small. In most Western countries, the contribution of livestock to income from agriculture is as high as 82 per cent in Denmark, 81 per cent in Ireland, 79 per cent in Sweden, and 78 per cent each in Norway and the United Kingdom. If, however, livestock-raising in India is brought on proper and scientific lines, there is a great potential to increase the productivity of our animals and obtain a substantial increase in their contribution to the national economy.

It is, therefore, hoped that the information, as presented in the pages that follow, besides familiarising the reader with the country's livestock, will help in disseminating correct knowledge about the habits and requirements of the various types of domestic animals and the steps needed to improve their productive efficiency.

In a book of this kind, where a number of different species of animals are dealt with, the author has necessarily to draw upon numerous sources of information and published material available on the subject. These are gratefully recorded in the bibliography given at the end of the book. The bibliography will also help the reader in obtaining more detailed information on any particular aspect of the subject in which he may feel specially interested. The author is also grateful for permission to use photographs and illustrative material obtained from various sources.

New Delhi
11 April 1966

HARBANS SINGH

PREFACE TO THE SECOND EDITION

The second edition of the book is being brought out in a revised form with up-to-date statistics so as to make it more useful for the reader.

I wish to express my gratitude to Mr B.P.S. Puri, B.Sc. (Dairying) for his valuable help in the revision of the book and also for making useful suggestions.

The book has already been published in Hindi, Punjabi, Marathi, Telugu and Tamil. I hope it will continue to be of interest to the general reader.

New Delhi

Harbans Singh

PREFACE TO THE THIRD EDITION

The first edition of this book appeared in print during April 1966. 'Domestic Animals' has provided information on the wealth and diversity of the Animals whom man has domesticated successfully and put to a variety of uses e.g. food, work, transport etc.

After the second edition which appeared in 1980, it has become necessary to extensively revise this book so as to provide the latest available data and its impact on Society.

India has a large population—next only to China. India's equally large livestock population at 369.03 million means that there is at least one domestic animal for every two humans in the country.

Cattle constitute the most significant part of our livestock with a population of 241.96 million including 61.96 million buffaloes. Sheep and goats total 116.24 million whereas horses, mules, donkeys and camels constitute another 3.16 million heads. Pigs at 7.6 million are another important segment of the total livestock population.

Livestock contributes nearly 10.6% of the country's National Income from agriculture. This estimate does not include the significant value of draught power supplied by working animals. In Rupee value the current livestock contribution exceeds Rs.10,000 crores per year.

India possesses nearly 12% of the total livestock population of the world and if all these animals are made to stand in a single file, they will go round the world at the equator about eleven times and will easily cover the distance from the earth to the moon.

India's cattle population equals that of North America. In spite of this large number of cattle which includes about half of the world's buffaloes, one-eighth of the world's cattle and one-sixth of world's goat population, the milk production in India is only 28,355 thousand metric tons in 1977 for which the last recorded census figures are available. North America, with only 40% of our cattle population, produces nearly three times the amount of milk that we produce. The average per capita daily consumption of milk in India at 123 gms is woefully inadequate for nutrition and is only a fraction of the consumption in countries such as USA, Newzealand, Australia etc. where the consumption ranges between 600 and 750 gms daily.

The milk yield of the Indian cattle is very low compared with that of the other countries. Against an average annual milk yield per milking cow of 4401 kgs in Denmark, 4156 kgs in Switzerland, 5386 kgs in the United States of America and 4773 kgs in the United Kingdom, the average yield of the cow in India is only about 500 kgs. Indian buffaloes yield somewhat more but the average yield has to be drastically improved to make any significant impact on total availability in India.

Programmes are underway for increasing the milk production and unofficial estimate anticipate that India will produce fortyone thousand metric tons during 1985-86.

There are 80.64 million working animals in India. The gross area available for cultivation is 156.78 million hectares. This means that a pair of bullocks is able to till only 3.9 hectares of land. One of the factors responsible for the low yield of crops in India is obviously the poor working capacity of our draught animals.

The position of other species of livestock is equally dismal. India stands fifth in the world with regard to the population of sheep. But the major portion of the wool obtained in India is of low quality. It is hairy, coarse and is not suitable for making superior cloth. The annual yield of wool per sheep is also very low, the average being 700 grams, while in some of the exotic breeds, the fleece yield is 5 to 7 kilograms. As regards mutton, the average weight of sheep in India varies from 25 to 30 kilograms only. Exotic sheep weigh over three times as much.

As for poultry, India has a very small number of birds at 159.22 million. There are only 25 chicken per 100 persons against 540 in Denmark, 373 in Canada, 286 in the United States of America, 179 in the United Kingdom, and 150-200 in other European countries. The number of birds per square kilometre in India is the second lowest in poultry population of the world.

Latest estimates of India's Annual Poultry Meat Production at 136 thousand metric tonnes work out to only 0.47% of the total world poultry meat production. India's total egg production at 775 thousand tonnes is not much better as it constitutes only 2% of the total world egg production. The annual laying capacity of the Indian hen is less than half of the world average and only one-fourth of that in the developed countries.

Basically, livestock rearing in India is carried on under a variety of adverse climatic and environmental conditions. Animal husbandry centres round the small cultivator, to the large majority of whom livestock-raising is an occupation subsidiary to crop production. The cultivator is generally poor and resourceless. He lives on small fragmented holdings of less than two hectares of land maintaining two to three animals. In some of the European countries, the strength of an average herd is over 50 animals. Grazing during greater part of the year is poor except during the monsoon. Marketing facilities are extremely inadequate and a large part of the marketable surplus of milk produced in rural areas, where about 95 percent of the cattle population is reared, is sold as ghee, which is the least remunerative of all milk products. Even that does not fetch the producer the full value because in the absence of an effective marketing organisation and because of the smallness of the size of the herd, the moneyed middle man usually steps into exploit the needs of the cattle owner and takes away most of his profits. The cultivator is thus deprived of all incentive to pay enough attention to the development of his livestock.

The main handicaps in the promotion and growth of livestock industry in India are not only the adverse climatic and other environmental factors, but such fundamental ones as the poor genetical potential of the large majority of the present-day livestock and the acute shortage of feeds and fodders. Whatever be the inherent qualities of the animals, they are not able to make these qualities effective in actual production unless they are properly and adequately fed. The shortage of feeds, at present, is probably the greatest limiting factor in improving the efficiency of Indian livestock. Only about 4% of the total area is available as permanent pastures and other grazing land which is inadequate for feeding the large animal population.

In India, livestock contributes only 10.9 per cent of the net income from agriculture. In view of the enormity of the livestock population of the country, this contribution is very small. In most Western countries, the contribution of livestock to income from agriculture is as high as 82 per cent in Denmark, 81 per cent in Ireland, 79 per cent in Sweden, and 78 per cent each in Norway and the United Kingdom. If, however, livestock raising in India is brought on proper and scientific lines, there is a great potential to increase the productivity of our animals and obtain a substantial increase in their contribution to the national economy.

Winds of change have started to make an impact on the dismal Indian scene. Cooperatives are emerging strongly to provide a total package of assistance in breeding, production and marketing of livestock produce in selected areas of the country. These areas and those others where marketing channels are well established have shown that a dramatic improvement can take place in the ability of our livestock to feed and enrich us.

It is, therefore, hoped that the information, as presented in the pages that follow, besides familiarising the reader with the country's livestock, will help in disseminating correct knowledge about the habits and requirements of the various types of domestic animals and the steps needed to improve their productive efficiency.

In a book of this kind, where a number of different species of animals are dealt with, the author has necessarily to draw upon numerous sources of information and published material available on the subject. These are gratefully recorded in the bibliography given at the end of the book. The bibliography will also help the reader in obtaining more detailed information on any particular aspect of the subject in which he may feel specially interested. The author is also grateful for permission to use photographs and illustrative material obtained from various sources.

New Delhi HARBANS SINGH
April 13, 1986

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I

CATTLE

INTRODUCTION

CATTLE were domesticated at a very early stage of human civilization. They served through ages as objects of worship and mythology. Drawings and carvings on the walls of caves in Egypt and India depict cattle as beasts of burden. The excavations of Mohenjodaro and Harappa indicate the use of cattle in India as early as 5,000 years ago. The Great Ox or Auroches, which Caesar mentioned in his writings, is considered to be one of the progenitors of the modern dairy breeds.

India is one of the few countries in the world where buffalo is found in domesticated form. The other countries which possess significant numbers of buffaloes are China, Thailand, Pakistan and Philippines. Buffaloes commonly seen in India are not found in European countries. The American buffalo is really a Bison. Buffaloes in their wild state are generally found in grass-jungles near swamps. Domesticated buffaloes differ from the wild ones by their smaller size of body, horns, and development of milk characters.

The buffalo, on an average, gives almost three times more milk than the cow. Buffalo milk is also richer than that of the cow and contains about 50 per cent more fat. The buffalo-bullock is an animal of strength. It moves slowly but can draw very heavy loads over long distances.

In India, cattle play a vital role in rural economy. Bullocks are still an important source of motive power in the agricultural operations although they are fast being replaced by machines. Milk is the major source of animal protein in the diet of a large number of people. Cattle replenish the fields by supplying manure and contribute hides and skins after death. Next to land, cattle are the peasant's most precious possession. They are useful to him in many ways. He uses his cattle for ploughing, harrowing, thrashing, harvesting, lifting water and for transporting the produce to the market. It is estimated that, on the whole, bullocks put in about 12,000 million working hours annually for ploughing fields and working on other agricultural operations.

The trend in recent years has shown that in India, for road transport, bullocks are gradually being replaced by mechanised means. But for the purpose of cultivation, various factors, such as small size of holdings, absence of avenues of employment other than agriculture, and shortage of fuel and steel, militate against the use of tractors for cultivation on any substantial scale in the foreseeable future.

India produced 28,355.20 thousand tonnes of milk in 1977-78. The largest quantity, 5,447 thousand tonnes, was produced in Uttar Pradesh. The other important milk producing States were Punjab 2,709 thousand tonnes, Bihar 1,828 metric tonnes, Andhra Pradesh 1,830 metric tonnes, Rajasthan 2,879 metric tonnes and Madhya Pradesh 2,000 metric tonnes. Total production of milk in 1985-86 is estimated at 41,000 million tonnes.

In India, according to the livestock census of 1977 , there were 242.1 million head of cattle including 62.0 million buffaloes and their progeny. This showed 10.6 per cent increase over that of 1956 in the case of cows, bullocks and calves, and 13.9 per cent increase in the case of buffaloes and their progeny. There were 32.6 million cows and 40.26 million buffaloes over three years of age, out of which 23.1 million cows and 16.2 million buffaloes were in milk.

According to the Livestock Census of 1977, there were 129.36 million heads of cattle, including 396.89 million buffaloes. This showed an increase of 0.3 per cent and 3.3 per cent over that of 1977 in the case of cattle and buffaloes, respectively. There were 23,188 million cows and 16,959 million buffaloes in milk, while 26,592 million cows and 11,920 million buffaloes were dry. In 1977, there were 241.96 million head of cattle, out of which 61.96 million were buffaloes and their progeny. Statewise Andhra Pradesh had 12.25 million cattle, Assam 9.58 million, Bihar 18.68 million, Gujarat 6.38 million, Haryana 3.68 million, Himachal Pradesh 3.31 million, Jammu & Kashmir 3.09 million, Karnataka 12.23 million, Madhya Pradesh 50.00 million, Maharashtra 19.45 million, Orissa 15.97 million, Punjab 5.00 million, Rajasthan 19.22 million, Tamil Nadu 11.40 million, Uttar Pradesh 28.09 million and West Bengal 17.80 million.

In the case of buffaloes, there were 8.41 million in Andhra Pradesh, 0.91 million in Assam, 6.72 million in Bihar, 5.93 million in Gujarat, 5.74 million in Haryana, 0.86 million in Himachal Pradesh, 0.66 million in Jammu & Kashmir, 4.22 million in Karnataka, 0.31 million in Kerala, 11.44 million in Madhya Pradesh, 5.63 million Maharashtra, 1.82 million in Orissa, 7.68 million in Punjab, 9.54 million in Rajasthan, 4.13 million in Tamil Nadu, 20.22 million in Uttar Pradesh, and 5.2 million in West Bengal.

IMPORTANT BREEDS OF CATTLE

The number of breeds of cattle in the world is surprisingly great. In Europe there are as many as 40 to 50 distinct breeds. In Great Britain alone, there are 11 breeds which have been evolved to suit special requirements.

Although the majority of India's cattle is non-descript, there are 26 well-defined breeds of cattle and 6 breeds of buffaloes, distributed all over the country. These can be broadly classified into milch, draught and dual-purpose breeds. The females of the dual-purpose breeds are fairly good milk-yielders and bullocks are good for draught purposes. Red Sindhi, Sahiwal and Tharparkar breeds have their original home tracts in Pakistan, but a number of well-bred herds of these breeds are at present being reared in India.

Amritmahal is a distinct draught breed of Mysore State. These animals are fiery, active and are noted for their power of endurance. Bullocks are specially suited for trotting and quick transport. The cows are, generally, poor milk-yielders.

Amritmahals have a well-shaped and narrow head. The forehead is deeply furrowed. The eyes are bright and in some cases blood shot. The barrel is long and well rounded. The navel flap is closely tucked up. The legs are medium in length and well proportioned. The hoofs are hard, black with narrow clefts. The tail is fine and of moderate length. The udder is small and compact. The teats are hard and small. The animals are generally white and sometimes grey in colour.

Bachuar is a medium draught breed found in Sitamarhi district in Bihar. These animals can thrive under poor conditions of feeding. The bullocks are good for work. The cows are poor milk-yielders.

The main characteristics of this breed are medium head, broad forehead, large and drooping ears, thick horns, curving upwards and forwards, pendulous dewlap, compact body, small tucked up sheath, strong and well shaped legs, and thick short tail with a black switch. The common colour of this breed is grey.

Bargur animals originate from the Bargur hills of Coimbatore district in Madras State. They closely resemble Hallikar cattle. They are small, compact and attractive animals, fiery in disposition and very difficult to train. They are good in endurance and are noted for their speed. Cows are poor milk-yielders.

The animals of this breed have a long head, slightly prominent forehead, deep furrow between the roots of the horns, long pointed horns starting close at root and curving backwards and upwards, fiery eyes, compact body, fairly light sheath, short legs with hard hoofs and thin tapering short tail. The udder is undeveloped and teats are small. The colour of the body is usually red and white, sometimes light grey.

Dangi is a medium-sized animal which originates from Akola taluk of Ahmednagar district, Ghats of Nasik, Thana and Kolaba districts and former States of Baroda and Dangs. These cattle are hardy and thrive in heavy rainfall tracts. The bullocks are specially suited for working in rice fields. The cows are poor milk-yielders.

The chief characteristics of this breed are a small head, bulging forehead, long face, short thick horns, long deep body, short stout legs, and powerful quarters. The usual colour is red or brown or black and white.

Deoni is a medium-sized breed which originates from the North-Western and Western parts of Andhra Pradesh. These animals resemble Gir breed to a great extent.

Deonis can be described as having a medium-sized head, slightly prominent forehead, pendulous ears, thick horns curving outwards and backwards, wedge-shaped barrel, long tapering tail, compact and medium-sized udder with well-placed teats. The colour of these animals varies considerably but black and white or red and white are most common.

Gaolao is a dual-purpose breed found in Wardha and Chindwara districts of Madhya Pradesh.

The chief characteristics of this breed are a long narrow face, stumpy horns with short ears, long and narrow body, short muscular limbs, moderately developed sheath, and short tail. Cows are usually white and the males are grey over the neck, hump and quarters.

Gir is a medium-sized animal, found in Gir forests of South Kathiawar and Junagad. It is also found in Western Rajasthan, Baroda and Northern parts of Maharashtra. The cows are good milk-yielders.

These animals have a massive head, extremely bulging forehead, narrow face, long and pendulous ears, resembling a curled-up leaf with a notch at the tip. Horns are of medium thickness curving backwards, upwards and forwards ending in a spiral inward sweep. Barrel is long, deep and well rounded, legs well proportioned and squarely placed, udder of good shape with well-placed teats. The Gir cattle vary considerably in colour but are usually red, black and red, red and white or speckled red and white.

Hallikar breed is found in the districts of Hassan and Tumkur in Karnataka State. It is a well-known draught breed of South India, suited for both road and field work. Cows are poor milk-yielders.

These animals have a long head and a bulging forehead which has a distinct furrow in the middle. The horns are close and spring perpendicularly from the head. They are carried backward in a graceful sweep on each side of the neck and then curve upwards to terminate into sharp points. The navel flap is well tucked up, body is long and compact, legs light and long with a fine tail. Udder is small and compact. The colour of this breed is dark or light grey with white patches round the face and dewlap.

Hariana is a dual-purpose breed found in the districts of Rohtak, Karnal, Hissar, and Gurgaon of the Punjab, Union Territory of Delhi and Western Uttar Pradesh. The bullocks are powerful animals, good for road transport and rapid ploughing. The cows are good milk-yielders.

These animals have a light head with a long and narrow face. Horns are short and somewhat horizontal. In bullocks, the horns grow longer than in cows and curve upwards and inwards. The barrel is long and compact, the legs are long and strong with well-shaped hoofs. The tail is fine and short. In cows the udder is well-developed with prominent teats. These cattle are generally white or light grey in colour.

Kangayam is a medium sized draught breed which originates from South-East Taluks of Coimbatore in Madras State. The bullocks are strong and active, suitable for heavy plough and road transport. Cows are poor milk-yielders.

In Kangayams, the head is short and the forehead broad. The horns curve outwards, backwards and almost complete a circle at a point where they approach the tips. Barrel is compact and medium in length, legs short, sheath small, and tail moderately long. In cows, the udder is of medium size with small teats. The prevailing colour is white or grey with black markings on the knees and just above the fetlocks on all the four legs. Calves are red in colour at birth, which changes to white when they are about four months of age.

Kankrej is one of the heaviest and most powerful breeds of cattle. These animals are found in the South-East of the Rann of Kutch and from Deessa in the East to extreme end of old Radhanpur State in the West. Bullocks are fast, active and strong and are good for both plough and cart. Cows are fairly good milk-yielders.

These animals have a narrow face and broad forehead which is slightly dished. The eyes are big with wrinkles above the eyelids. The horns are thick, symmetrical and curve outwards, upwards and inwards with the pointed tip curved backwards. The barrel is long, deep and compact, legs strong and straight with hard hoofs. The udder is medium in size with good shape. These cattle are usually silver or iron grey in colour. The females are lighter in colour than the males. In newly-born calves, the poll is generally red in colour which disappears when they are six months old.

Kenkatha (Kemvariya) animals are found in the district of Bundelkhand and along the Ken river of Banda district in Uttar Pradesh. They are also found in Panna, Bijaigarh and Charkhari districts of former Vindhya Pradesh. The bullocks are good for light draught work. The cows are poor milk-yielders.

The chief characteristics of this breed are short head, broad forehead, strong pointed horns emerging forward from the poll, deep and compact body, medium sized sheath, strong short limbs and fairly long tail. The animals are usually dark grey in colour.

Kherigarh is a draught breed which is found in Lakhimpur Kheri district of Uttar Pradesh. The bullocks are good for light work. Cows are poor milk-yielders.

The characteristic features of these animals are a medium-sized head, thin and very long upstanding horns, broad and deep barrel, light limbs and thin and long tail. These animals are generally white in colour.

Khillari is a medium-sized and compact draught breed which originates from Sholapur and Satara districts and Satpura range of former Bombay State. These animals resemble Amritmahal breed, except that they are bigger in frame with coarser shoulders. The bullocks are fast and powerful draught animals. The cows are poor milk-yielders.

These animals have a massive head with a deep furrow in the centre of the forehead. The horns are long and pointed, emerging close to each other at top of the poll in upward direction. The barrel is long and compact, legs strong and long, sheath small, tail thin and short. In cows the udder and teats are small.

These animals are usually greyish white in colour.

Krishna Valley breed is found in the valley of Krishna river in the Southern portions of former Bombay and Hyderabad States. These animals are mostly found in Sholapur, Miraj, Sangli, Belgaum, Satara and Dharwar districts. The bullocks are highly valued for their capability to work in the black cotton soil. The cows are fair milk-yielders.

These animals have a small head, wide forehead, short and thick horns curving upwards and outwards. The barrel is deep, legs short and muscular and tail thin, almost touching the hock. The prevailing colour is greyish white with a darker shade in the fore and hind quarters in the males.

Malvi is a medium-sized draught breed found in the Malwa tract, comprising the former States of Gwalior, Indore, Bhopal and the adjoining parts of Central India. The bullocks are well-known for draught qualities, especially for working in black cotton soils. The cows are poor milk-yielders.

The characteristic features of this breed are a small head, dished face, curved horns emerging forward from the polls in an outward and upward direction. The body is deep and compact, legs strong, short and powerful. The tail is long almost touching the fetlocks. The prevailing colour is grey with black markings over the neck, shoulders, hump and quarters. The colour changes with age.

Mewati (Kosi) breed originates from the Kosi tract of Mathura district and the former States of Bharatpur and Alwar. The bullocks are small but useful for drawing heavy plough and cart. The cows are fair milk-yielders.

These animals have a medium-sized head and bulging forehead. The horns are thick, curving outwards and upwards then inwards and backwards. The barrel is long and deep. The legs are short and fine. The tail is thin and long. The teats are of medium size. The prevailing colour is white with dark shade on the head, neck, shoulders and quarters.

Nagore is a draught breed belonging to Nagore and Jodhpur districts of Rajasthan. The bullocks are big, powerful, active and are capable of heavy draught work in deep sands. They also trot well and are prized for fast road work. The cows are comparatively small in size and are poor milk-yielders.

The main characteristics of this breed are a small head and flat forehead. The horns are well-developed, curving upwards and outwards, then inwards. The body is long and compact, legs strong, sheath tucked up and tail short. The prevailing colour of these animals is white.

Nimari is a draught breed found in the valley of Narmada river. These animals are very active. The bullocks are prized for draught work. Cows are poor milk-yielders.

This breed has a long head and bulging forehead. The horns are medium-sized, curving upwards, outwards and finally backwards at the tips. The body is long and deep, udder well-developed sheath somewhat pendulous, and limbs strong. These animals are red in colour with large splashes of white in the various parts of the body.

Ongole (Nellore) breed comes from Nellore and Guntur districts of Andhra Pradesh. It is also found in the dry taluks of Krishna and Godavari. The bullocks are heavy and powerful, suitable for cart work and heavy plough. They are not generally used for fast work. The cows are fairly good milk-yielders.

The main characteristics of these animals are a medium-sized head, broad forehead, short and stumpy horns, growing outward and inward, deep barrel, strong legs, long and tapering tail. Loose horns are also common in this breed. The udder is medium-sized and the teats are evenly placed. The typical colour of this breed is white or greyish or white with black or dark grey markings on the hump, neck and quarters. Young calves are white with reddish brown patches which generally change to white at the age of about six months.

Ponwar is a draught breed which is found in Pilibhit and Lakhimpur Kheri districts of Uttar Pradesh. The bullocks are active and very useful for draught purposes. The cows are poor milk-yielders.

These animals have a coarse head, narrow face, concave forehead, long pointed horns, curving upwards and backwards, long deep barrel, short and strong legs, tight sheath and long tapering tail. The prevailing colour of this breed is black and white.

Rath is a medium-sized breed found in the North and North-West of Alwar in Rajasthan. These animals are small in size and are economical to maintain. The bullocks are compact and active. The cows are fairly good milk-yielders.

These animals have a flat forehead, small horns, emerging laterally from the poll and curving inwards at the tip, moderately long body, short and muscular limbs, small tucked up sheath and long tail. These animals are usually white or grey in colour.

Sindhi (Red Sindhi) breed has its original home in West Pakistan, around Karachi and North-West of it, including the area of Baluchistan where a distinct type of considerable purity is bred. This breed is spread over a large area around the Western banks of the Indus river. Pedigree herds are also found in Karnataka, Madras, Travancore, Orissa and Punjab. These animals have great adaptability and do well outside their own habitat. The bullocks are small and are used for light work. The cows are high milk-yielders.

Sindhis have a moderate-sized head and broad forehead. The horns are short and thick, emerging laterally from the poll. They curve upward, forward and inward ending in blunt points. The barrel is long, deep and wedge-shaped. The legs are short and the tail is long. The udder is of good size with medium teats. The breed is invariably red in colour, but some animals may be found with white markings.

Sahiwal (Montgomery) is a medium-sized animal, bred in large numbers in the dry, Central and Southern areas of West Pakistan near the river Ravi, particularly in Montgomery district. It is also bred in most of the large cities of the Punjab. Pedigree herds are found in the Punjab, Uttar Pradesh, Bihar and Delhi. In wet climates, these animals do not thrive well. The bullocks are lethargic and slow. Cows are good milk-yielders.

The main characteristics of this breed are long head and medium-sized forehead. The horns are short and thick, emerging laterally from the polls. The barrel is wedge-shaped, loosely knit with loose skin under the abdomen at the place of navel. The back is long with an elevation from withers to hook bones and drooping from hook to pin bones. The legs are short. The udder is well-developed, inclined to be pushed forward from behind with good-sized teats. Sahiwals are, generally, red or light red in colour. In some animals patches of white colour are also found.

Siri breed is found in hill tracts of Darjeeling, Sikkim and Bhutan. These animals have a thick coat to protect them against severe cold and rain. The bullocks are massive and good for pulling heavy loads with great ease on mountainous roads. In the plains, these animals do not fare well.

The main characteristics of the breed are a small head, flat forehead, pointed horns, directed forward and slightly upwards, massive and deep body, short and strong legs, and short tail. The general colour is black and white or red and white.

Tharparkar is a medium-sized dual-purpose breed. Its home is the arid, semi-desert tract of Tharparkar district in Pakistan. These animals are also red and reared in many parts of India, specially around Jodhpur, Kutch and Jaisalmer. The cows possess good milk-yielding capacity. The bullocks are good for drawing both plough and cart.

These animals have a medium-sized head and broad forehead. The horns are well apart, curving upwards and outwards in the same line as that of the poll. They are medium in length, fairly thick at the base with blunt points. The barrel is compact and wedge-shaped. The legs are short. The tail is long and thin. The udder is large, well-developed with good-sized teats. The breed is generally white or grey in colour.

Jaffarabadi buffaloes are bred in the Gir forest of Kathiawar, specially in and around Jaffarabad. These animals are heavy milkyielders. Individuals have yielded 15 to 20 kilograms of milk per day with a high butter-fat content.

The main characteristics of this breed are a heavy head and a bulging prominent forehead. The horns are broad and flat, drooping on each side of the neck and turning up at the points with a loose curve. The body is wedge-shaped. The udder is large and well-developed. These animals are usually black in colour, with white patches on the face and legs.

Mehsana breed of buffaloes comes from Baroda and neighbouring areas. These animals are of medium size. They are considered economical for milk and ghee production. They are valued for their early maturity, persistency in milk-yielding and regularity in breeding.

These animals have a heavy head, long face, thick horns with loose curl, long wedge-shaped body, light limbs with well-developed udder. The animals are black in colour with white markings on the face, legs and tip of the tail.

Murrah buffaloes are bred in Southern Punjab and the Union Territory of Delhi. The best breeding tract comprises Rohtak, Hissar, Jind, Nabha and Patiala districts of the Punjab. These animals are noted for milk and ghee production and have been introduced in many parts of India. The average lactation yield is about 1,500 to 2,000 kilograms of milk with a butter-fat content of seven per cent. Individual buffaloes have given 25 to 30 kilograms of milk a day.

The chief characteristics of this breed are small and clean head. Forehead is slightly prominent. The horns are short, flat and turning backwards, upwards and curling inwards in a spiral form. The body is massive, long, deep and wedge-shaped. The udder is prominent and well-developed with good-sized teats. The animals are black in colour with white markings on switch of the tail.

Nagpuri (Ellichpuri) buffaloes are largely found in Central and Southern India. The males are slow movers but are largely used for draught purposes. The females are fair milk-yielders. The daily average yield is six to eight kilograms of milk.

These animals have a long head and broad forehead. The horns are long, curved and carried back on each side of the neck, often behind the shoulders. The barrel is long and deep with light limbs. The tail is comparatively short. Nagpuri buffaloes are black in colour with white patches on face, legs and the tip of the tail.

Nili buffaloes are found in the Montgomery district of Pakistan and the Ferozepore district of the Punjab. This breed derives its name from the deep water of the Sutlej river. Males are commonly used for heavy draught work. She-buffaloes are heavy milk-yielders. The average milk yield is 1,700 kilograms in a lactation period of 250 days.

These animals have a bulging forehead. They are wall-eyed. The horns are small with very tight curl. The skin is soft with scanty hair. The body is long, deep, medium-sized and wedge-shaped. The legs are short.and tail is long. The udder is well-developed. The usual colour is black with white markings on forehead, face, muzzle, legs and switch.

Surti breed of buffaloes has its home in Charotar tract of Gujarat comprising Kluda and Baroda districts. The best specimens are found in Anand, Nadiad, Borsad and Petlad. The buffaloes are economical producers of milk. They are exported to Bombay city in large numbers. The average lactation yield of well-bred animals is 1,700 to 2,000 kilograms. Good specimens yield 2,500 to 2,700 kilograms in a lactation.

Surti animals have a long, broad head, bulging forehead, flat and sickle-shaped horns, wedge-shaped body with medium legs, well-developed udder and a long and thin tail. The colour is black or brown with scanty hair which are silvery or brown in colour. Good specimens have two white collars, one round the jaw and the other at the brisket.

EXOTIC BREEDS USED IN INDIA

To improve the milk-yielding capacity of the indigenous cows, a number of exotic breeds of dairy cattle have been used in India on a fairly extensive scale. The most important of these breeds are Jersey, Holstein-Friesian, Ayreshire, Brown Swiss, and Guernsey. Recently a small number of German Fleckvieh (Spotted Mountain) cattle has been imported from West Germany. Of all the exotic breeds, Holstein-Friesian apd Jersey cattle have been most extensively used. Of late, however, there has been increasing demand for Jersey bulls in the country.

Jersey breed was developed on the Island of Jersey in the English Channel. It is the smallest of the dairy breeds and produces milk most economically.

These cows have straight top lines, level rumps, and sharp withers. Jerseys have excellent udders, both in shape and in fore and rear attachments. Jerseys vary in colour from light fawn to black and from white-spotted to solid in marking. The switch may be black or white. The muzzle is black with a light and circling ring.

In India, Jersey breed has done very well. The milk yield of first generation progeny obtained by use of Jersey bulls on indigenous cows has increased by about two-and-a-half times that of their dams. The age of maturity and inter-calving period in the progeny is also very much reduced.

Holstein-Friesian cattle had their origin in Holland. They were specially bred to produce large quantities of milk for use in making cheese.

Animals of this breed are ruggedly built. They possess large feeding capacity and udder. The head is long, narrow, and straight. The cows are quiet and docile. Holsteins are black and white, and the amounts of black and white may vary from white with a few black spots to almost black. The switch is always white.

In India a half-bred cow *Parvathy*, from a Friesian sire and an indigenous dam, gave 46 kilograms of milk in a day.

Ayreshire breed was developed in Scotland. It is considered as the most beautiful dairy breed.

The cows have straight top lines, level rump and good udders. Ayreshires have long horns which are trained upward. These animals are very active and sometimes hard to manage. Ayreshires are of red colour with white markings or white with red markings. The red may be very light or almost black.

Brown Swiss cattle were developed in the mountainous areas of Switzerland. These animals are used in Switzerland for draught as well as for milk and beef, and as a result are not as refined as the other dairy breeds.

Cows of this breed have large bones, large heads which are usually dished, and thick, loose skin. This breed is quiet, docile, and easily managed. The colour varies from a light fawn to almost black. The muzzle and strips along the backbone are light in colour. The nose, switch, and horn tips are black.

Guernsey breed has been bred in the small Island of Guernsey, which is located off the coast of France. These animals are less rugged than the Holstein, but more rugged than the Jersey.

The cows are inclined to be rough over the rump and weak in the loin. The udders are less symmetrical than those of the Jersey. The face of the Guernsey is double-dished but longer than that of the Jersey. Cows of this breed are alert and active. They are easily managed. The colour of the Guernsey varies from a light fawn to almost red, with white markings on the face, legs, switch and flank.

German Fleckvieh (Spotted Mountain) cattle are bred in South and South-West Germany, mainly in a continental climate, ranging from a vine-growing to an Alpine climate. This wide range explains the special adaptability which has been demonstrated by numerous exported animals of this breed in European and overseas countries. These animals are considered specially suited to rugged hill conditions. In India these animals have recently been introduced in Himachal Pradesh.

BREEDING OF CATTLE

The age of maturity in cattle depends on various factors such as the breed, nutritional level, state of health of the animal, and the environmental conditions. Under Indian village conditions, cattle generally mature at the age of about three years.

A cow comes into heat every 19 to 21 days. The duration of the heat period varies from 12 to 24 hours. The optimum time of service is mid-heat to the end of heat. The average gestation period in the cow is 280 days. In she-buffaloes, the heat period recurs every 21 to 23 days. The duration of the heat period is

18 to 36 hours. The optimum time of service is mid-heat to the end of heat. The average gestation period in the buffalo is 310 days.

Great care should be taken in selecting the bull for breeding. Bull is half the herd and only the best available should be selected for use. The bull should be typical of the breed and should come from parents with high milk yield. Milk is an inherited character which the calf inherits from its dam and sire. The bull should, therefore, belong to a family where the females have given good yields.

A bull should not be used for breeding purposes unless it attains proper maturity. Only in exceptional cases should bulls be used before they are three years old and that too very sparingly. Generally, one bull is considered sufficient for 60 to 70 cows or buffaloes of breedable age. Under good conditions of management and feeding, the number of females may be increased to 100.

The milch cow or buffalo selected for breeding should be vigorous and healthy. She should have a marked wedge-shaped body. She should have a loose-knit frame, without any tendency to put on fat. She should be gentle and mild in temperament.

The milch animal must have a good mammary system. The udder should be symmetrical in shape. It should be large and capacious, attached high up between the thighs, and extend far forward towards the navel. A good udder should be soft and pliable and should collapse after milking. The udder should be flat on the lower side and rounded behind. The teats should be well-shaped, uniform, and of good size. They should be cylindrical and evenly placed. Milk veins on the udder should be large, numerous and well-branched. Prominent veins on the udder ensure good blood supply to the udder and more milk in the pail.

The cow or buffalo, when in heat, shows signs of restlessness. Its milk-yield and appetite are reduced. There is a flow of transparent mucous from the genital opening, which shows signs of swelling and congestion.

With proper feeding and care, a cow will come into heat within

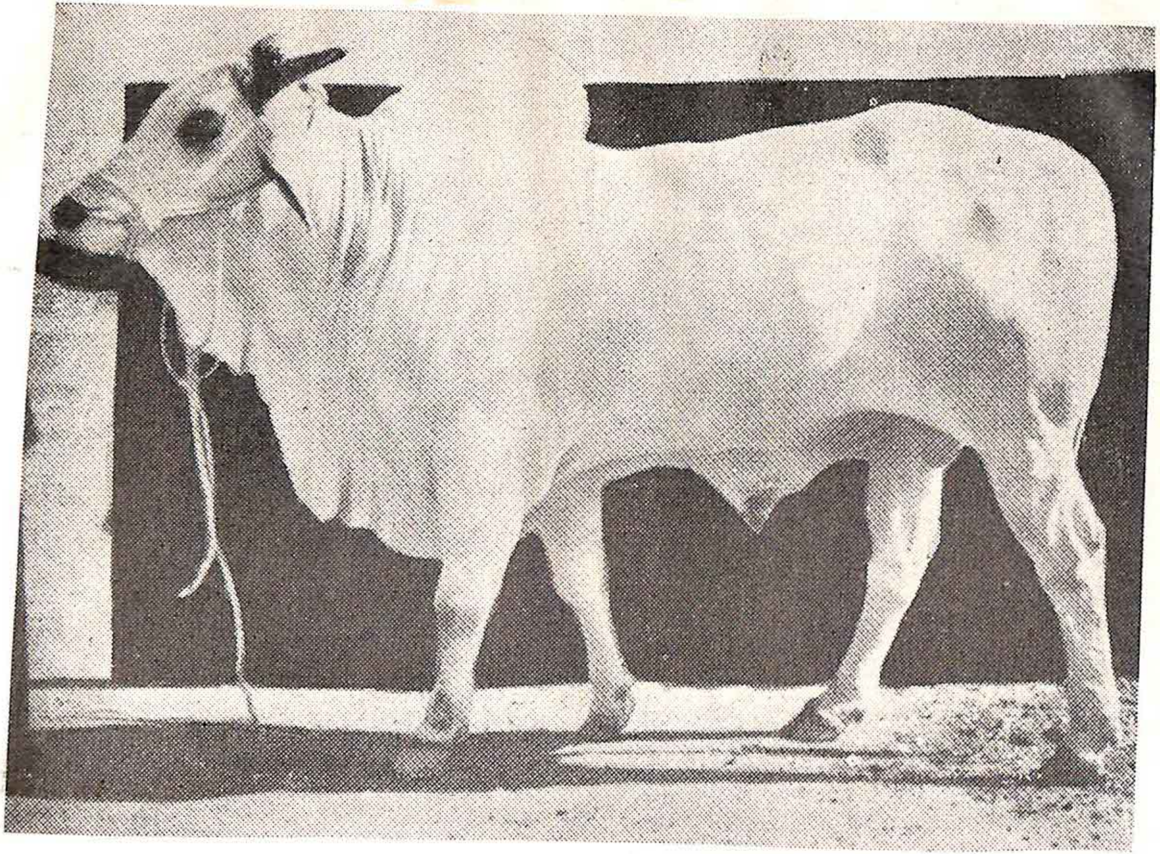

Fig. 1. Ongole Animals Are Heavy And Powerful
(See page 9)

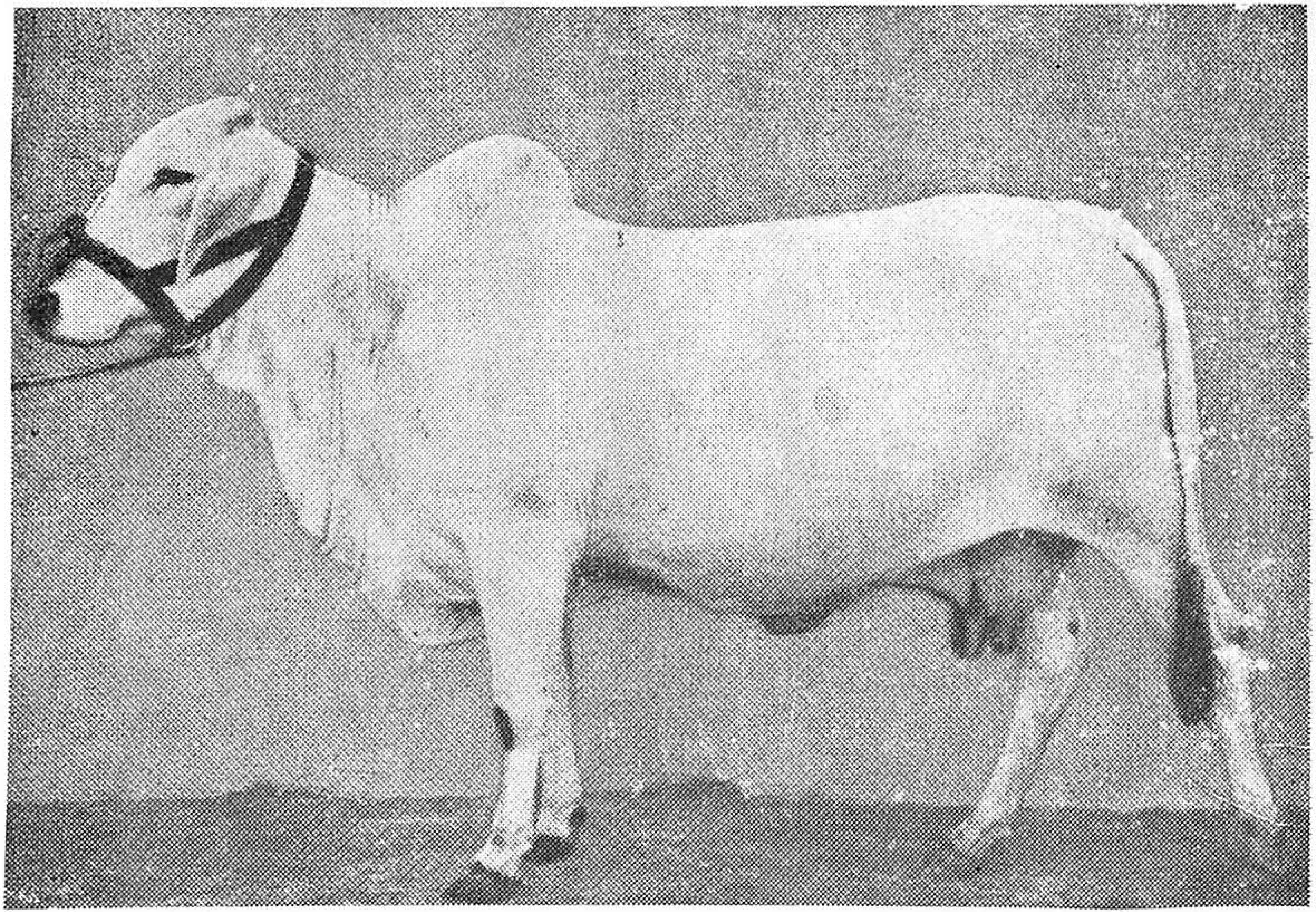

Fig. 3. A Tharparkar Cow
(*See page 11*)

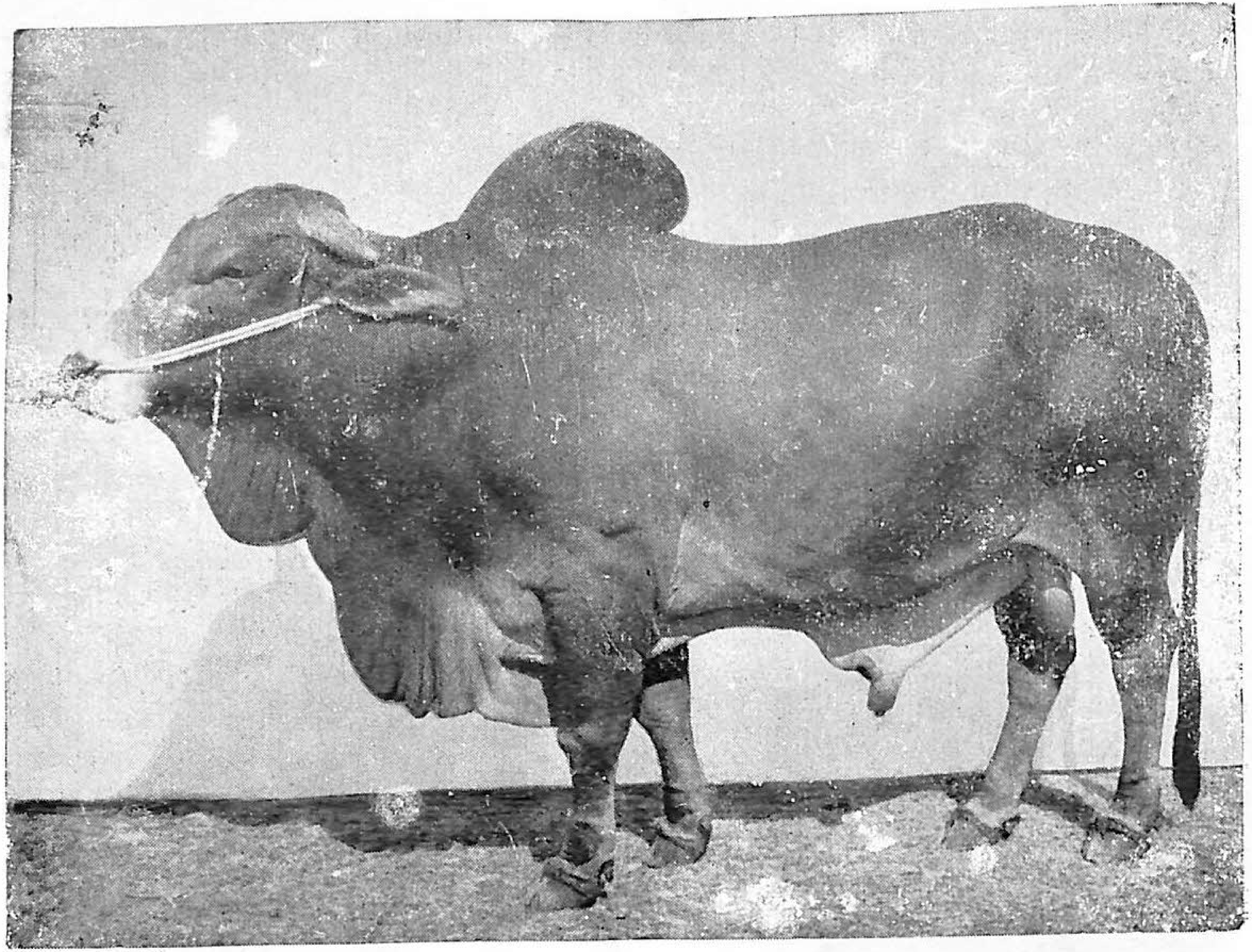

Fig. 2. A Sindhi Bull
(See page 10)

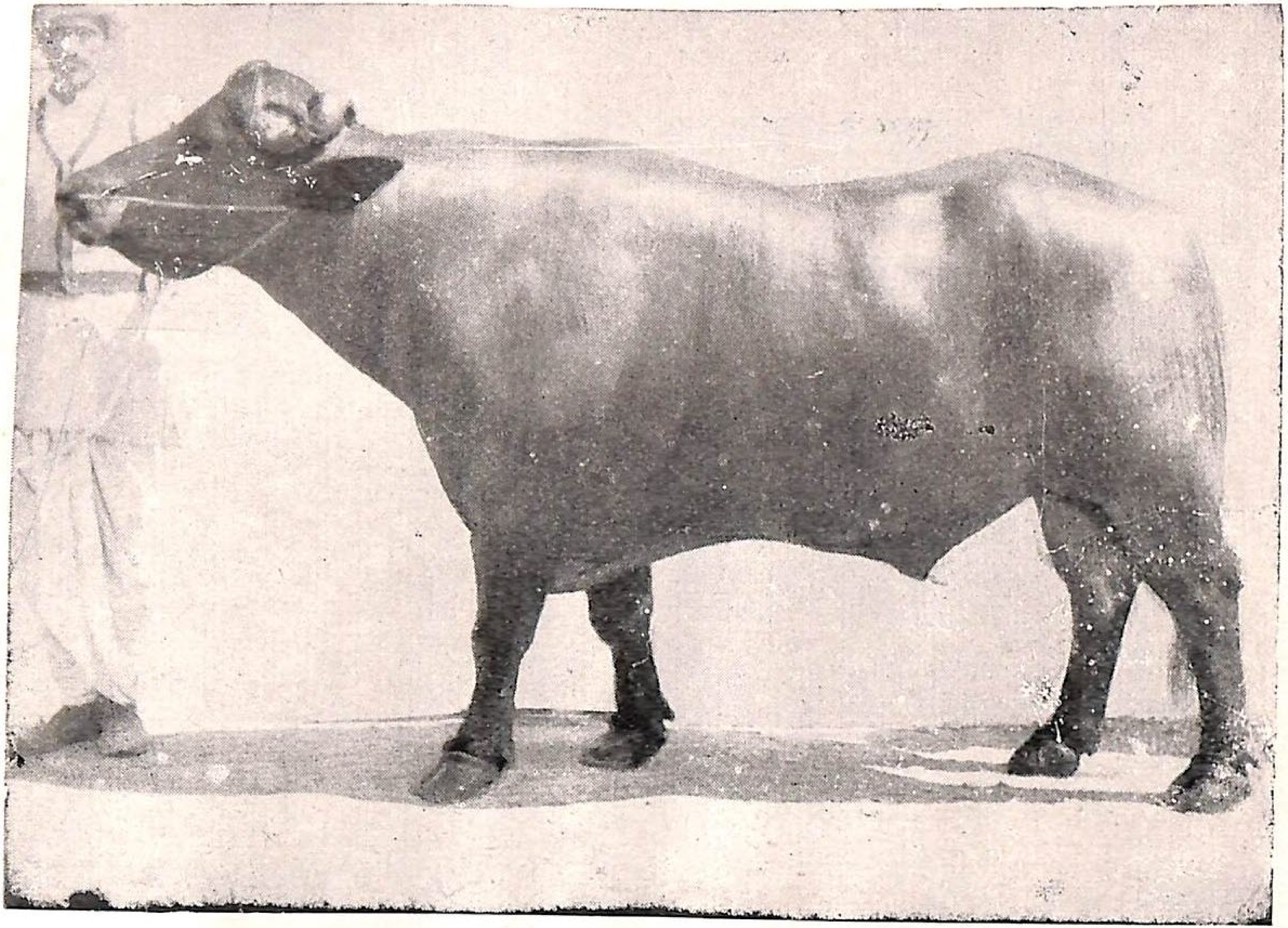

Fig. 4. Murrah Breed is Spread In Many Parts of India
(*See page 12*)

100 days of calving. The service should not be withheld unnecessarily for a long period. The shorter the interval between the successive calvings, the more economical the animal is as a milk-yielder.

A cow may be served naturally or she may be artificially inseminated. Artificial insemination has many advantages. It is more economical than maintaining a stud bull, especially in small herds. It makes possible a wider use of superior bulls. Semen from bulls located at distant places can be used. By artificial insemination, spread of certain diseases can also be controlled.

In a pregnant cow or buffalo, milking should be discontinued about six to eight weeks before calving. This will enable her to get sufficient rest before the next lactation period. The pregnant cow should not be made to walk long distances or run fast. She should not be allowed to be butted by other animals.

The chief signs of approaching parturition in a cow or buffalo are diminished appetite, the genital opening is congested and swollen with yellowish mucous discharge. The animal urinates frequently and in small quantities. Udder is distended. There is a depression near the pin bones. The animal seeks seclusion and shows signs of restlessness by frequently waving the tail and by sitting and standing at short intervals.

During calving there should not be any unnecessary interference. As far as possible, nature should be allowed to have its own course. A warm bran mash just before and after calving should be given to the animal. As soon as the calf is born, the mother should be encouraged to lick the calf. If, for any reason, she fails to do so, the mucous from the mouth and the nostrils of the calf should be removed and cleaned. The body of the calf should be gently rubbed with a gunny until it is dry. The navel cord of the calf should be tied about 2·5 centimetres away from the body and cut about one centimetre below the ligature.

Normally, the cow or buffalo throws the after-birth within five to six hours. The after-birth should be removed as soon as it falls, otherwise the animal may eat it. If necessary, the calf should be helped to suckle the teats.

A good cow or buffalo gives milk for nine to ten months. Cow's milk, on an average, contains 3·39 per cent proteins, 3·68 per cent fat, 4·94 per cent sugar, 0·74 per cent minerals and 87·27 per cent water. The buffalo milk contains 4·37 per cent proteins, 7·65 per cent fat, 4·82 per cent sugar, 0·94 per cent minerals and 82·22 per cent water. Fat in milk increases as lactation advances.

FEEDING THE CATTLE

Cattle are herbivorous animals. They convert plants and vegetable feeds into milk, meat and working energy for the benefit of man. For efficient production, the animal needs sufficient well-balanced feed. The feed must be satisfying, both qualitatively and quantitatively.

Cattle like other ruminants have four stomachs. The first three are the enlargement of the food pipe. They enable an animal to take large quantities of food at a time, to be processed and chewed at leisure. The first stomach acts as a store for food which has been cut into small pieces and mixed with saliva. The second stomach acts as a store for water. When the animal has finished eating, the solid portion of food is sent back to the mouth by the contraction of the first and the second stomachs. After it is chewed again and converted into a finer mass, it goes direct to the third stomach. In the third stomach, by the help of its folds, the food is squeezed and ground. It then passes to the fourth stomach where it is acted upon by digestive juices.

In feeding cattle, care should be taken that they are provided well-balanced ration throughout the year. Underfeeding for a short period takes the cow a much longer period to come back to her normal production. The quantity of grain ration should be adjusted for each animal according to her milk production or work. The ration should be palatable, with plenty of good roughage. Cattle always love to have a variety in their food. Mixing of different types of fodders gives better results. The feeding stuffs which are laxative in nature should be preferred. Such feeds keep the animal healthy. While introducing change in ration, it should be done gradually to enable the animal to adjust itself to the change. The grain ration should be coarsely ground and soaked for some time before feeding. This improves its digestibility.

As far as possible, the milch animals should be provided with green and succulent fodder all the year round. Green fodders are not only highly palatable and whet the appetite but also increase the milk-yield. Green fodders are the best source for supply of vitamins to the animal. The milk produced by animals, which are not fed sufficient green fodder, lacks in some of the essential nutritional elements. Green fodders, particularly legumes such as berseem, lucerne and cowpeas, are most suitable for milch animals. They supply protein, minerals and carotene.

Silage is the best substitute for green fodder. It helps in keeping up the yield of milch animals during dry months. Silage is nutritious and easily digested by cattle. Silage even from plants with coarse stalks is eaten practically without any waste.

An average cow needs daily about four to five kilograms of dry grass or *bhoosa,* about 15 to 20 kilograms of green fodder and one kilogram of grain mixture. The buffalo requires about one and a half times more. In addition, a milch cow should be given one kilogram of concentrate mixture for every two and a half kilograms of milk produced. In the case of a buffalo, for every two kilograms of milk, one kilogram of concentrate mixture should be given.

A pregnant animal should get an extra allowance of about one kilogram of grain mixture during the last two months of pregnancy. This is the time when she is preparing herself for the coming lactation. If she is not fed properly during this period, she would not be able to yield good quantity of milk in the following lactation, nor will the calf be strong and healthy.

Stud bulls, during the period of active service, should be given an additional allowance of two kilograms of grain ration. The bullocks at medium and heavy work would require daily one and three kilograms of additional grain ration, respectively.

The actual composition of the grain mixture would largely depend upon the availability of the feeds and their cost. Ordinarily, a good concentrate mixture should contain one part of crushed grain, two parts of bran or husk and one part of oil-cake. One kilogram of the grain ration prepared by mixing 25 parts of cotton seed meal, 55 parts maize and 20 parts wheat bran is enough for a cow to yield 2·5 kilograms of milk and two kilograms of milk in the case of a buffalo.

In the case of a new-born calf, mother's first milk called colostrum, should be given for four or five days. If it is not available, the calf should be fed whole milk to which a little castor oil, cod-liver oil and the white of an egg have been added. Up to a month, the calf requires about 2·7 kilograms of milk a day. Later on, this can be replaced gradually by skim milk, until the age of 24 weeks, when skim milk may be discontinued. When the calf is two to three weeks old, it begins to nibble at hay or soft grass. The hay should be of good quality. The calf may be provided with grain mixture when two to three weeks old. The quantity of grain ration may be increased gradually to about one kilogram daily at the age of about six months.

A suitable grain ration for calves can be prepared by mixing 30 parts wheat bran, 20 parts each of barley meal, jowar meal and maize meal, and 10 parts linseed cake.

For all classes of adult cattle, common salt should be added to the grain ration at the rate of 50 to 60 grams daily. The young calves should have free access to salt-lick, failing which they should be provided with 25 to 30 grams of salt daily. For high-yielding milch animals and for growing youngstock of improved breeds, mineral supplement is also necessary. The mineral supplement may be prepared by mixing 45 parts finely powdered sterilised bonemeal, 10 parts ground chalk, 12 parts dicalcium phosphate, 30 parts common salt, half a part of yellow oxide of iron, 2·25 parts of potassium iodide, 0·75 parts sodium carbonate, 0·75 parts starch and 1·75 parts sodium thiosulphate. To every 100 kilograms of the mineral mixture, 50 grams of powdered cobalt chloride, 250 grams of copper sulphate and 300 grams of manganese sulphate should be added. This mineral mixture when added at the rate of two kilograms to every 100 kilograms of the grain ration, offers sufficient protection against possible deficiencies not only of major elements like calcium and phosphorus, but also of trace elements such as copper, cobalt, manganese and iodine.

In rice-growing areas, paddy straw forms the major portion of the roughage feed for cattle. Paddy straw has a low nutritional value. It can, however, be made a more palatable and better-balanced feed by supplementing it with a small quantity of leguminous green fodders.

It is more economical to feed animals with chaffed fodder. By chaffing fodder not only wastage can be prevented, but it also enables the animals to chew and digest the feed properly and save much of the energy which results in better milk yield and work.

Water is essential for the physiological functions of the animal such as digestion, absorption of nutrients and the elimination of wastes. It also regulates the body temperature. Animals can live much longer without solid food than without water. Water forms more than half the weight of a mature animal. Milk contains about 81 to 85 per cent water. It is, therefore, essential that sufficient water should be made available to the cattle at all times. It is a mistake to assume that suckling calves do not require water because they are being fed largely on milk. A milch cow, under normal conditions, requires daily about 32 litres of water in addition to 2 litres of water for each litre of milk produced. A working bullock would need 32 litres of water daily. Idle cattle require about 22 litres a day.

General Management of Cattle

Cattle should always be treated gently and with kindness. They should never be frightened or excited. Regularity in feeding, grazing and milking nowhere pays better dividends than in the case of milch animals.

Milking of Animals

Milch animals are often spoiled by not using the correct method of milking. Milking should be done quickly, gently and

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completely. Full-hand method for milking should be practised. The animals should be milked with dry hand. The thumb should not be placed between the palm and the teat while milking. It often damages the teats.

Milk is not necessarily clean even when it does not show any visible dirt. Clean milk should also be free from organisms which may cause disease. Milk ·may act as a carrier of bacteria of a number of diseases of man such as typhoid fever, dysentery, diptheria, septic sore-throat, scarlet fever and tuberculosis. Unclean milk becomes sour more quickly than clean milk. Once the milk becomes unclean, it cannot be made clean again. Therefore, scrupulous care should be taken to keep the milk free from any contamination.

The milking shed should always be kept clean. Milk vessels should be thoroughly sterilised. The animal, especially its hind quarters, should be properly washed before milking. The milker should be neat and clean and free from any communicable disease. The first few strips of milk from each teat should not be mixed with the rest of the milk as they contain the highest number of bacteria.

The animals should be groomed daily to remove dirt and loose hair from their body. Grooming also stimulates blood circulation and improves their health.

WEANING OF CALVES

Weaning of calves at birth is generally practised in some of the countries. Milking without a calf is more sanitary and hygienic. Weaning enables the feeding of calf more precisely. Weaned calves can be reared more economically on whole-milk substitutes. Weaning of calves also saves milking time. It enables the owner to keep exact records and the cow can be fed in accordance with her actual milk yield. Sometimes, if the calf dies, there is difficulty in milking the cow. If the calf is weaned, no such difficulty is experienced.

For weaning calves successfully, the cow should not be allowed to see the calf at birth. The calf should be removed from the mother immediately after birth. It is easier to wean calves from the first calvers.

All hygienic precautions should be taken in feeding of weaned calves. Weaned calves should be fed with milk warmed to the body-temperature. The calf in the beginning may be helped to take milk from the pail. This can be done by dipping the hand in the pail and allowing the calf to suck through the fingers which are gradually withdrawn. The young calf often butts while sucking milk from the bucket. This is normal in a new-born calf. It butts to bring the milk down in its mother. The feeding bucket should be properly secured to avoid spilling. The mouth of the calf should be washed and the muzzle should be put for sometime after every milk feed, otherwise the calves get the habit of licking each other.

DEHORNING OF CALVES

Dehorning is commonly practised in milch cattle, especially in large dairy herds. Dehorned cattle are easier to handle than those with horns. Calves can be dehorned when one to two weeks old.

To dehorn a calf, it should be held in a position that it cannot move freely. The hair around the horn buds on both sides of the head should be clipped. Vaseline should be applied on the outer edges of the circles. The horn buds should be cleaned with a little spirit, and rubbed with caustic potash stick in a circular motion for a minute or two, leaving a raw reddish circle. Oozing of blood should be avoided. After dehorning, the calf should be kept tied for a day or two, to avoid injury to the affected parts.

CASTRATION OF BULL CALVES

Castration is one of the most feasible means of controlling the reproductive ability of cattle. Breeding through inferior bulls causes deterioration in the genetic potential of the progeny. Therefore, elimination of undesirable male calves, not required for breeding, through castration is commonly practised all over the world. In India, where other channels of eliminating inferior animals are not available, castration is perhaps the only means of checking their indiscriminate breeding.

Moreover, by castrating male calves, robust bullocks having greater docility can be developed. Castrated animals can be more conveniently housed and handled. The young male calves, not required for breeding, should be castrated at as early an age as possible, in any case before the age of 15 to 18 months. Sometimes, there is a belief among cattle-owners that early castration affects the body development of the animal and, as a result, the bullocks become less hardy and of smaller size. But there does not seem to be any basis for such a belief. On the other hand, it has been observed that by castrating the bull calves at the proper age, the docility and activity of the bullocks are rather markedly improved.

Castration can be done during any part of the year. The rainy season should, however, be avoided. In different parts of the country, different seasons are preferred for getting animals castrated. The methods of castrating animals commonly used in villages are painful and unhygienic. The most efficient method is to use the Burdizzo castrator. With it, a bloodless and painless operation can be performed.

To perform the operation, the animal should be made to lie on one side and its legs secured. The sperm cord should be held tightly and one should make sure that it does not slip. Two cuts should be given on each side of the cord. The second cut should be given at a lower level than the first to avoid unnecessary pain. The Burdizzo should not be placed too low on the cord as it may crush the testicles. The cut should be given on cords of both sides of the testicles. The punch should be given quickly and evenly. Tincture of iodine should be applied on the cuts to avoid infection.

In Western countries, a strong and tight rubber ring is commonly put round the cord with the help of a forceps when the calf is very young. This exerts constant pressure. When the testicles have been absorbed, the ring drops down.

CARE OF DRAUGHT CATTLE

The draught cattle should not be overworked. The work should be distributed in such a way that all the bullocks share it equally. The bullocks should be properly shod before using them for thrashing grain or for other work on hard ground, as otherwise there is a danger of their feet getting injured. The hoof should first be prepared, and then the shoe fitted to the hoof. The hoof should never be cut to fit the shoe. The shoe should be made to fit the natural shape of the hoof. Animals on road work may require shoeing once a month. Those working in the field require renewal of shoes once in two or three months. Animals with soft hoofs require shoeing more frequently than those with hard hoofs.

A good draught bullock should have good carriage and disposition, showing health and vigour. Animals that keep their head erect when standing and their tail high when at work, are generally considered more alert and brisk. The bullock should be of good size and height. The length of the body shows good speed. The animal should walk fast, and freely with an easy gait. The neck should be muscular and strong. A thick neck denotes heavy draught capacity, while a thin, slender and sinew neck indicates speed. A tight skin goes with great sensitivity and fiery temper. The feet should be hard, black and waxy. The two halves should be even. The cleft of the hoof should be narrow.

DETERMINING THE AGE OF CATTLE

The age of cattle can be determined from their teeth. Cattle have no front teeth on the upper jaw. A calf at birth has two temporary incisors or milk teeth in the lower jaw. At one week, it has four, at two weeks six, and at four weeks eight milk teeth. At the age of two years, the permanent incisors start coming up. Normally, at about 2 to 2½ years, there are two permanent incisors. At about three years there are four permanent incisors. At four years there are six, and at about five years, there are eight permanent incisors.

After the age of five years, the age of cattle can be judged by noticing the extent of wear and tear of the teeth.

HOUSING OF CATTLE

To obtain a high level of production from cattle, it is necessary to provide them protection from the inclemencies of weather. They should always be kept in comfortable, sanitary and well-ventilated houses where water and other facilities are available. The site for the building should be at a higher level than the surrounding area to allow good drainage. The cattle-shed should be so designed as to make handling and feeding animals easy. The direction of prevailing winds should be well sheltered. As far as possible, a cattle-shed should not be too close to human dwellings. The building should not be expensive but should be comfortable and sanitary.

A cow-shed can be designed with due regard to the number of animals to be kept. For a small number, standing space in a single row with a feeding trough in front and a drain at the back is considered adequate.

Calves should be kept separately and should be brought to the cows only at the time of milking. The grown-up calves should be kept separately from suckling calves. After the age of six months, the male and female calves should be kept in separate enclosures.

Bull-shed should have a large enclosure to allow free movement and exercise for the bull.

The flooring of cattle-sheds should be *pucca*. The best material for the purpose is cement concrete which can be washed and cleaned every day. The floor must not be slippery. This can be done by either laying rough concrete or designing some pattern.

The provision of a good drain channel in a cattle-shed is very important. The drain should be wide enough to hold dung and urine, which can be removed at regular intervals.

If possible, the cattle urine should be drained directly to the pit from the cattle shed. Otherwise, straw bedding should be provided under the animals. The straw will also absorb liquid excreta which can be easily removed along with cowdung, and dumped in a manure pit.

The method of conserving cattle dung followed in the villages is to pile up the dung and other refuse in heaps on the ground.

This is not desirable, as it results in a great deal of waste of plant nutrients from the manure through the action of wind and rain and is also insanitary. The proper method is to store the manure in a pit. Urine, which is a very rich part of the manure, should also be properly conserved.

Generally, each cow requires about six square metres of space. The buffalo requires more. If the number of animals is large, there should be a separate stall divided by iron pipes or wooden poles, for each animal. Each stall should have a feeding passage in front, a feeding trough, standing space and a drain at the back. The animals can be placed in two rows, either face to face or tail to tail.

Signs of Ill-Health in Cattle

Cattle are subject to a large number of diseases. Diseases take a heavy toll of the lives of cattle every year. Diseases also lower the productive efficiency of the animals and thus result in a great economic loss to the owner.

Cattle in normal health appear bright, active and alert in their movements. They enjoy normal sleep and appetite. The first signs of ill-health are the cessation of rumination, and drop in milk yield. There is a discharge from the eyes, nostrils, and mouth. The animal is restless and frequently changes postures. The other important symptoms are dull eyes, drooping ears, dry muzzle, rough coat, hard breathing, rise in temperature, and higher rates of pulse-beat and respiration.

The normal body temperature in cattle is about 38·3 degrees C (101 degrees F). Temperature can be observed by inserting an ordinary clinical thermometer in the anus of the animal. The pulse rate varies from 40 to 60 per minute. The pulse can be felt on the underside of the tail near its root. Respiration varies from 15 to 30 per minute. In the case of a buffalo, the normal body temperature varies from 37·2 to 38·8 degrees C (99 to 102 degrees F). The pulse rate varies from 40 to 45 per minute. Respiration rate ranges from 16 to 18 per minute.

Most of the contagious diseases in cattle can be prevented and controlled by timely vaccination and by observing suitable precautions. Prevention is better than cure, is the golden rule which should always be borne in mind when dealing with animal health.

In case of any outbreak of a contagious disease, all animals should be carefully examined. Those which show any unusual symptoms should be immediately segregated. The premises should be disinfected thoroughly every time a suspected case is detected.

The infected animals should be kept separate. They should be looked after by separate attendants. Otherwise, the healthy animals should be attended to first and then the infected ones. Hands and feet should be properly disinfected after attending to the sick animals.

The healthy animals should not be sent to common grazing fields and to cattle markets during the outbreak. The infected pasture should be ploughed up and a layer of slaked lime should be applied. It should be kept open for a few months. The carcass of infected animals should be disposed of by burning or burying with the infected beddings and litter. The carcass should be buried in a pit two metres deep, covered with a layer of lime, if cremation is not possible.

IMPORTANT DISEASES OF CATTLE

Anthrax is a contagious and rapidly fatal disease of cattle and buffaloes. It is also communicable to human beings.

The main symptoms of the disease are high temperature, 41 degrees C (106 degrees F), with severe congestion of the visible membranes of the eyes and mouth. Swellings may appear on different parts of the body, which are neither painful nor hot. There is bloody discharge from natural openings. The affected animal may die within 10 to 36 hours.

Preventive measures consist in immediate segregation of healthy animals. The infected carcass and litter should be disposed of through burial or by burning. The place should be thoroughly disinfected. The skin of the dead animals should not be removed. In badly infected localities, the animals should be vaccinated before the onset of rains. Anti-anthrax serum should be given to incontact animals.

Black-quarter is an acute, infectious and highly fatal disease of cattle. Young cattle, six months to two years old, are most susceptible. It is a soil-borne infection and may be limited to a particular locality. It generally appears during monsoon season. The course of the disease is rapid and the animal dies within a few days.

The chief symptoms are acute rise in temperature, lameness, hot and painful swellings of varying size, situated usually on well-developed muscular areas such as the hind-quarters, shoulders and neck. The skin of the affected area is dry, dark and crapitates on pressing.

Preventive measures include segregation of healthy animals and keeping them out of infected fields. Contaminated pastures should be put under cultivation. Infected carcass and litter should be disposed of through burial or by burning. In badly infected areas, the animals should be vaccinated before the onset of rains. In the event of an outbreak, the incontact animals should be inoculated with anti-black-quarter serum.

Contagious abortion is a contagious disease of a chronic nature and is manifested by the premature expulsion of the foetus or untimely birth of the calf.

The chief symptoms are decreased lactation, loss of condition and frequent abortions in the herd. The act of abortion is generally preceded by uneasiness, secretion of colostrum and other normal signs of parturition. There is an opaque vaginal discharge which may appear a short time before the act of abortion. Abortion usually takes place in the last third part of the pregnancy period. Placenta is usually retained. Infection in bulls may lead to inflammation of testicles.

The disease can be prevented by adopting proper sanitary measures and good management. The animals showing evidence of the disease should be immediately isolated. Aborted foetus, after-birth and the soiled litter should be burnt. In suspected herds, the animals should be got tested with the agglutination test and all positive cases should be segregated. The animals should be inoculated with calf-hood vaccine at six to eight months of age.

Pox is a highly contagious disease affecting cattle including buffaloes. Milkers who have not been vaccinated against small-pox are liable to be affected by the disease.

The main symptoms are mild fever and retarded rumination, reddening and swelling of teats and surrounding parts, eruptions over the skin occurring most commonly on the udder and teats resulting into pustules followed by scale formation in about ten days. If the animal is not attended to properly, it may result in mastitis and complete loss of milk.

Preventive measures include isolation of the affected animals. The infected animals should be milked by separate attendants. After milking, the attendants should disinfect their hands carefully. If separate attendants cannot be arranged, the healthy animals should be milked before the affected ones.

Foot and Mouth disease is a highly contagious disease of cattle and buffaloes. Although it is not fatal except in youngstock, yet there is huge loss due to great reduction in milk yield and inability of affected animals to work.

The main symptoms of the disease are fever, diminished appetite, retarded rumination, decreased milk yield, lameness or soreness of the mouth. In the beginning, affected animals are seen shaking frequently one or more limbs. The mouth infection is first noticed by a peculiar smacking of the lips. There is profuse dribbling of saliva which hangs in a frothy mass from the lips. The appearance of vesicles is followed by ulcerations on the mucous membranes of the gums, lips and upper surface of the tongue, or inside the clefts of hoofs.

Preventive measures include segregation of the affected animals. The movement of animals should be restricted during outbreaks. The animals should be kept at rest until the sores are completely healed and should be tied on dry and clean ground. The mouth lesions and sores on the feet should be properly washed. To cut short the course of the outbreaks, the saliva from mildly affected animals may be applied to healthy ones. When a large number of animals have to be treated, they should be driven slowly through a foot-bath containing some antiseptic solution.

Haemorrhagic Septicaemia is an acute and most serious infectious disease of cattle and buffaloes. The disease is most prevalent in low-lying lands subject to periodical inundation. Serious outbreaks are generally experienced during the rainy season but a few cases may occur during other parts of the year.

The main symptoms are suddenness of attack and death within a few hours. There is a marked rise in temperature. The visible membranes are intensely reddened and there is dribbling of saliva from the mouth. There is a painful, hot and hard swelling of the throat and adjacent tissues. It may extend to the head and neck and sometimes to the forelimbs. Respiration is difficult, sometimes leading to suffocation. Constipation and colic may appear first and later on diarrhoea may set in.

The affected animals should be isolated. The infected carcass and litter should be disposed of by deep burial with lime. The animals should be vaccinated annually in the badly infected areas prior to the onset of rainy season. In the event of an outbreak the incontact animals should be inoculated with the anti-serum and other animals protected by vaccination.

Mastitis is a contagious disease causing inflammation of the udder among cows and buffaloes.

Acute form of the disease is more common after calving than at any other stage of lactation.

The common symptoms are inflammation of the affected quarter of the udder which is painful to touch. There is fever and the condition of the milk is altered which may appear watery or blood-tinged. Presence of clots in the milk is usually noticed.

The milch animals should always be kept under sanitary and hygienic conditions. Full-hand milking should be practised. Putting of thumb between teat and palm of the hand should be avoided. The affected animals should be isolated. All discharge and infected litter should be burnt.

Rinderpest is a highly contagious and fatal disease of cattle and buffaloes.

The chief symptoms of the disease are rise in body-temperature, ulcers on the mucous membranes of the lips, gums and undersurface of the tongue. There is a thick discharge from the eyes and mouth. Shooting diarrhoea with a characteristic offensive odour sets in. The animal is rapidly emaciated and dies.

The movement of cattle should be restricted during the outbreak. The infected animals should be segregated. The cattle sheds should be thoroughly disinfected. The carcass and the infected litter should be carefully disposed of. Anti-rinderpest serum inoculations should be given to infected and incontact animals. All healthy animals should be vaccinated as a preventive measure. Single vaccination gives life-long immunity.

Tuberculosis is a chronic infectious disease, affecting various species of animals including cows and buffaloes. It is also communicable to human beings either through infected milk or meat.

The chief symptoms of the disease are loss of condition, short, dry, husky cough and gradual emaciation. In case of abdominal form of the disease, there is recurrent tympany and intermittent diarrhoea. When udder gets infected, it shows signs of hardening and enlargement. The milk, at first, is unaltered, later becomes watery and greenish-yellow with a ropy deposit and is greatly reduced in quantity.

The animals should be kept under sanitary conditions. Overcrowding should be avoided. In suspected herds, all the animals should be got tested with tuberculin. The herd should be retested after every six months till declared free at two successive tests. The affected animals should be isolated. The calf should not be fed with milk from the infected mother. The infected carcass and litter should be properly disposed of.

Milk Fever is a common disease of cows and buffaloes. Heavy milk yielders, in good condition, are more susceptible. It usually occurs after the third calving when the animal is in its peak production. The animal is affected just before or after parturition within 72 hours of calving.

The main symptoms of the disease are dull and expressionless eyes, dry muzzle and excitement. The animal lies prostrate with

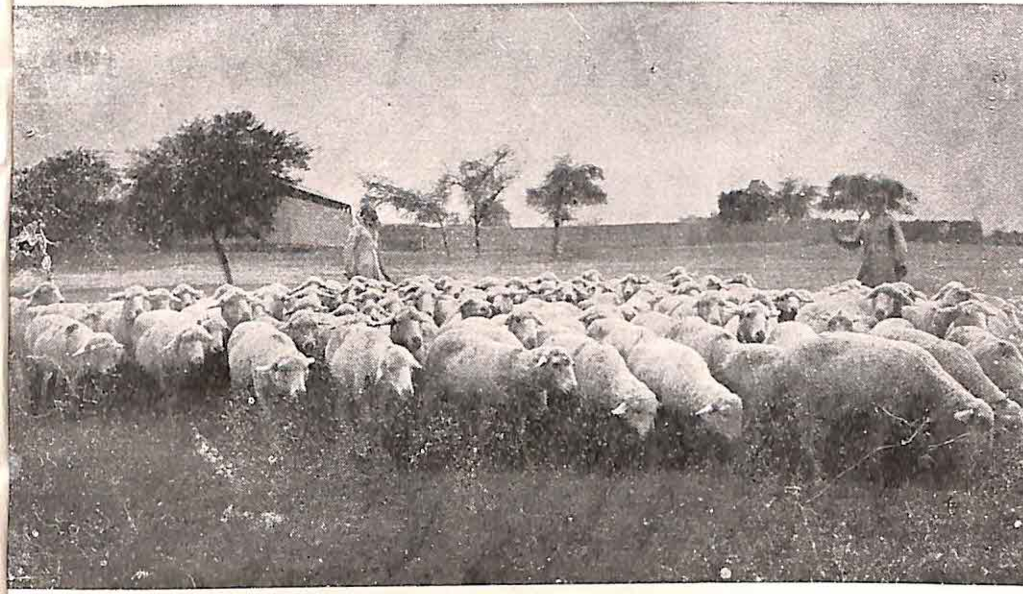

Fig. 5. A **F**lock of Indian Sheep
(*See page 35*)

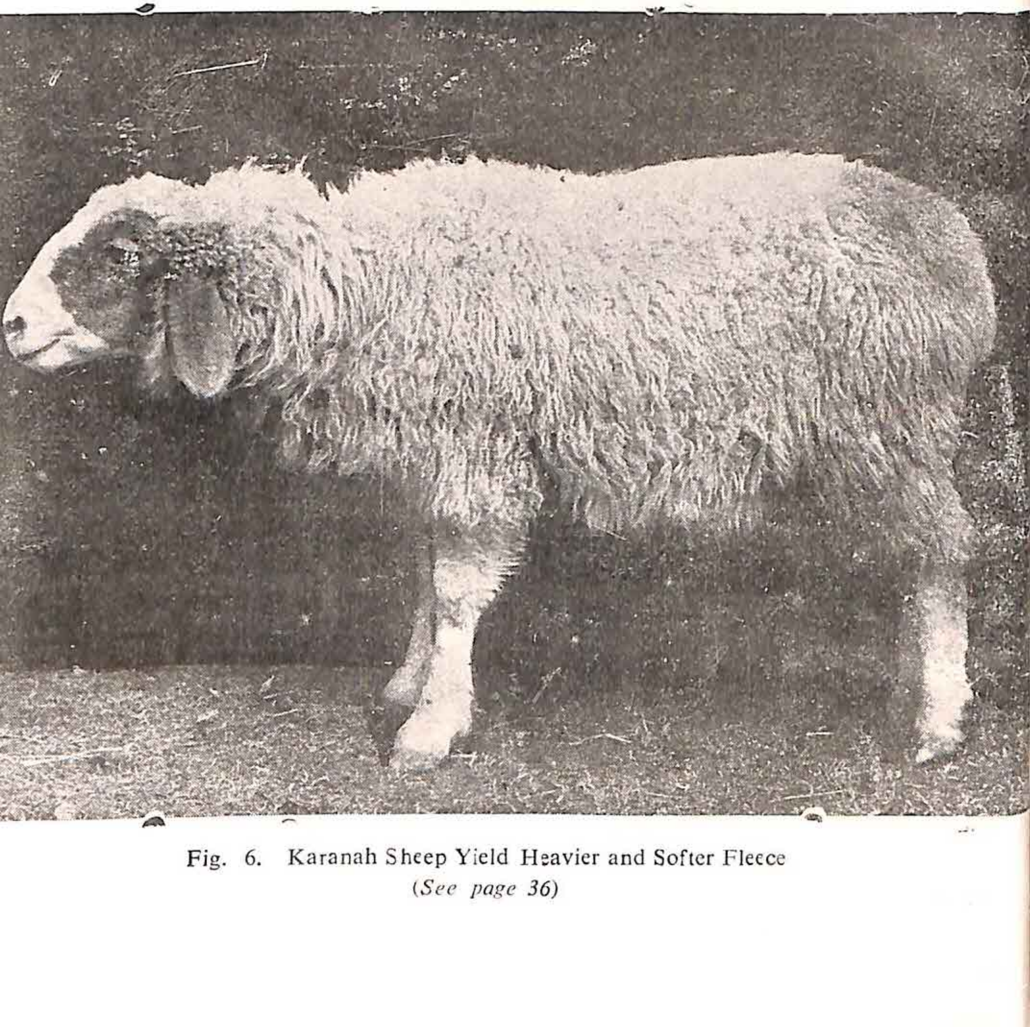

Fig. 6. Karanah Sheep Yield Heavier and Softer Fleece
(See page 36)

its head either turned round and rests on the chest wall with her nose pointing towards the flank, or stretches out resting along the ground. The temperature is usually below normal. Urination and passing of dung are temporarily stopped. The animal collapses and loses consciousness. Death may occur in 6 to 24 hours.

The udder of the affected animal should be cleaned with damp rag and a clean towel or a piece of cloth should be placed under the udder to prevent contamination from the soil. Each quarter of the udder should be inflated firmly using a cycle pump and the teats at the bottom should be tied with a clean tape to prevent the escape of air. The udder should be gently massaged to distribute the air throughout the udder. As a rule, the animal will rise to her feet within four hours after inflation, but occasionally, some may require re-inflation. The first sign of regaining consciousness is the dropping of dung and urination. The affected animal should not be milked for 12 hours after she has regained consciousness. The udder should not be completely emptied while milking for two or three days.

Ketosis. Ketosis is thought to be caused by a shortage of faulty utilization of sugar in the body. It usually affects either cattle fed for long periods on poor roughage without sufficient concentrates to balance the rations, or high-producing cows during the first month of lactation.

Symptoms. Animals affected by ketosis are nervous, lose their appetite, and there is a drop in milk production. High-producing cows are most susceptible.

Prevention and Control. Good rations with plenty of high-quality hay and silage are the best preventive measures. Some dairymen increase the carbohydrates for fresh cows by adding sugar or molasses to the ration.

Tympanitis is the distension of rumen with gases. It is commonly caused by eating a rich and easily fermentable green fodder, particularly when wet with dew and taken in a large quantity within a very short time. Water drunk in large quantities immediately after feeding on leguminous or succulent pastures hastens such an attack. Suckling calves that take excess of milk or animals with weak stomachs, poor in condition or those recovering from a disease are more prone to tympany.

The chief symptoms are: the animal stops feeding, looks very uneasy, stands with its back arched and looks towards its flank. The abdomen quickly becomes bloated, particularly on the left side and on tapping gives a drum-like sound. Due to discomfort, the animal grunts and groans. Breathing is difficult due to the bloated rumen pressing against the lungs. At times, the animal repeatedly lies down and gets up, salivates and gasps, with the tongue hanging out. Death may occur in very severe cases.

The hungry cattle should not have access to succulent, leguminous fodders. Sudden changes in feed should be avoided. At the early stages of the disease, the animal should be made to move about gently. The rumen should be massaged by exerting pressure on the left flank. Cold water may be put on the area of the rumen and turpentine oil rubbed on it. All food should be withheld till the acute stage is over. Water should be given in small quantities only. If the condition is very severe, the rumen may be punctured by a trocar and cannula or by plunging a sharp knife deep through the middle point in the left flank.

II

SHEEP

INTRODUCTION

SHEEP are perhaps the meekest of domestic animals. They have followed in the footsteps of man through the ages, contributing to his sustenance by supplying food and clothing. Sheep produce two different kinds of crops each year, wool and lambs. Sheep also provide rich manure. Sheep are excellent weed destroyers. Wherever sheep flocks are cared for and flourish, agriculture has thriven.

In India, in 1961, 33,298 thousand metric tonnes of wool, valued at rupees 122·6 million and 15·3 million sheepskins, valued at rupees 68·3 million were produced. The production of sheep meat was estimated at 131 thousand metric tonnes, valued at rupees 231·3 million, in 1959-60.

Sheep manure is considered a valuable source of fertilizer. An individual sheep adds 0·5 to 0·7 tonne of manure to the soil every year. It contains twice as much of nitrogen and potassium as is present in cattle manure. The annual value of sheep manure in India is roughly estimated at nearly rupees ten million.

In India, the maximum concentration of wool-yielding sheep is in the arid region of the North Indian plains and the Joria region comprising Rajasthan, Kutch, Saurashtra and North Gujarat. The Deccan Plateau has the largest population of flocks, particularly on the eastern side of Andhra Pradesh and Madras State. The majority of sheep of this area are, however, hairy and are of mutton type.

In India, there were 40.9 million sheep according to the Livestock Census of 1977. They constituted nearly four per cent of the total world sheep population. There was an increase of 9.7 per cent over that of 1972. In 1977, there were 40.90 million sheep.

Distribution of sheep in some of the major States in 1977 was : Andhra Pradesh 7.06 million, Bihar 1.15 million, Gujarat 1.59 million, Haryana 5.42 million, Himachal Pradesh 1.05 million, Jammu & Kashmir 1.2 million, Karanataka 4.53 million, Kerala 0.3 million, Madhya Pradesh 0.97 million, Maharashtra 2.5 million, Orissa 1.43 million, Punjab 0.42 million, Rajasthan 9.93 million, Tamil Nadu 5.28 million, Uttar Pradesh 2.05 million and West Bengal 0.72 million.

There were 10.5 million sheep in the world in 1974-76. They belonged to as many as 200 different breeds. They possess qualities varying in degrees in respect of milk, meat and wool yields. Of the total world wool production, 40 per cent is fine Merino wool and another 40 per cent is from sheep breeds derived from Merino. The remaining wool clip is classed as carpet wool.

IMPORTANT BREEDS OF SHEEP

Broadly speaking, there are three main types of sheep found in India. These types correspond to the three geophysiographic divisions of the country, the Temperate Himalayan region, the Dry Western region, and the Southern region.

The Temperate Himalayan region comprises Kashmir, Himachal Pradesh, and the hilly districts of Punjab and Uttar Pradesh. The sheep in this region have superior fleece with higher percentage of undercoat. The important breeds of this region are Gurez, Karanah, Bhakarwal, Gaddi and Rampur-Bushiar.

Gurez is an important breed of wool sheep. It is largely bred in Gurez Tehsil situated in the high elevated zone of Kashmir State. Its wool is long-stapled and lustrous white and less hairy. The average yield is about 1·5 kilograms per shearing. Its mutton is considered to be of a superior quality. Gurez is the biggest sheep among the Kashmir breeds. The majority of these sheep are hornless and have short ears.

Karanah sheep are chiefly bred near Kel in Kashmir State. They yield heavier and softer fleece. The colour of the fleece is generally white. The wool is mostly utilized locally for the manufacture of woollen articles. The Karanah rams have big curved horns, long face, and a prominent nose.

Bhakarwal breed originates from the lower hills of the Himalayas. These sheep are reared by a class of shepherds known as Bhakarwal.

These people graze their flocks on hill-tops in summer and bring them down to the plains in winter. The wool from these sheep is long, and is generally found mixed with coarser staple. The average annual wool yield per sheep is about 1·5 kilograms. The rams of this breed possess horns, but the ewes are hornless. The ears are generally long, broad, and drooping.

Gaddi (*Bhadarwah*) is an important breed of Kister and Bhadarwah tehsils in the Jammu region of Kashmir State. They are also reared in the Kulu and Kangra valleys of the Punjab, and in the Chamba and Mandi areas of Himachal Pradesh. The fleece of these sheep is generally white. The undercoat is used for the manufacture of high quality Kulu shawls and blankets. These sheep are of medium size and are sturdy climbers. The rams are horned. The ewes are hornless.

Rampur-Bushiar is an outstanding breed of the Himalayan region. The home tract of the breed is Mahasu and Kinnaur districts of Himachal Pradesh. These sheep have brown coloured fleece and a soft undercoat which is used in the manufacture of superior cloth. The annual yield of wool from these sheep ranges from one to two kilograms.

Dry Western region includes Rajasthan, South-East Punjab, Gujarat and parts of Western Uttar Pradesh. The wool from this region is considered suitable for carpet manufacture and is exported in large quantities. The principal breeds of this region are: Lohi, Bikaneri, Marwari, Kutchi and Kathiawari.

Lohi sheep originally belong to Lyallpur and Montgomery districts of Pakistan. A small number of these sheep is also found in the Punjab. This breed is well known for the production of quality mutton. The ewes yield appreciable quantities of milk. Its fleece is long-stapled and coarse. These sheep have graceful upright carriage. They are big in size and have specially long ears.

Bikaneri is an outstanding breed of Rajasthan. There are three distinct types of this breed—Chokla, Magra and Nial. These sheep yield superior carpet wool. The average annual yield per sheep is about 1·5 kilograms. Bikaneris are brown-headed. They are of medium size and have compact body.

Marwari breed is found in the Jodhpur and Jaipur divisions of Rajasthan. Selected flocks are raised in Pali and Barmer districts. Marwari sheep yield one to two kilograms of coarse, white wool. These sheep are black-faced. They are sturdy and have long legs.

Kutchi breed is known as Dhesi in Saurashtra and Gujarat. It originates from the deserts of Kutch. Selected flocks are raised in the Nalia area of Western Kutch. Wool from these sheep is used for the manufacture of army hosiery and tweeds. The colour of the fleece is white. The annual yield varies from one to two kilograms. It is considered a good dual-purpose breed. The sheep have a distinctive brown head and low-set body.

Kathiawari breed is raised in Kathiawar and adjoining parts of Kutch, Southern Rajasthan, and North Gujarat. The sheep yield long-stapled, coarse wool. They are usually of white colour with tan and black hair on the face and legs. The annual fleece yield is estimated at about 1·5 kilograms. These animals are of medium size, and are well built.

The Southern region comprises Maharashtra, Karnataka, Andhra Pradesh, Madras, and parts of Madhya Pradesh. Basically, there are two types of sheep in this region—wool type and meat type. The important breeds of this region are Deccani, Nellore, Bellary, Mandya, and Bandur.

Deccani breed is found in the South-Eastern parts of Maharashtra and in the neighbouring areas of Andhra Pradesh. The wool from these sheep is loose, coarse, and mixed with fine undercoat. It is generally of black or grey colours. It is mostly used by the local weavers for making blankets and carpets. The average annual yield is less than 500 grams. These sheep are maintained chiefly for meat. They are small but hardy animals.

Nellore is a hairy breed but is noted for producing good mutton. The usual colour of these sheep is white, sometimes black fawn markings are also found. Nellore is considered to be the tallest breed of sheep in India. The rams are horned and the ewes are polled. The tail of these sheep is generally very short with a hair whorl at the end.

Bellary sheep are found in the district of Bellary and parts of

Kurnool in the South. The quality of the wool is coarse and the usual colour is black. The average annual clip is about one kilogram. The skin of these sheep is considered to be of good quality. The sheep are large-sized and have compact bodies.

Mandya is an important breed of Karnataka State. Their wool is extremely hairy.

Bandur is a smaller type of sheep, which is well known for its high-quality mutton. It is bred in Bandur village of Mandya district.

In recent years, a few exotic breeds of sheep have been introduced in India for the grading up of indigenous sheep. Merino rams of Australian and German origins and Rambouillet rams have been used in large numbers. These have given encouraging results in improving the quality of indigenous stock.

Merino is the most popular fine-wool breed in the world. It has long been bred for wool production. It is popularly known as the golden-footed sheep. Merinos are extremely hardy and the ewes live and produce longer than most of the other breeds.

In India *Hissardale* has been evolved by crossing Merino rams with Bikaneri ewes. Hissardale combines the qualities of mutton, resistance to the adverse climatic conditions and diseases of the Bikaneri with those of the finer wool and size of the Merino. In general, its mutton quality is considered superior to that of the indigenous sheep.

Rambouillet breed of sheep is French in origin. These sheep produce excellent quality of fine wool and are also good for mutton. Rambouillets are prolific and good mothers, and are considered very suitable for range qualities.

BREEDING OF SHEEP

Although sheep as a class are reared in diverse climatic and pastoral conditions, introduction of a particular breed from one locality to another involves considerable risk. Ewes and rams of those breeds which have proved most suitable for the conditions available in the area should only be selected for breeding. The best course is to select good animals from the local flocks, and to improve them through selective breeding or by introducing new blood.

Selection of ram is most important in improving a flock. The ram should be masculine in appearance, strong and healthy. It should possess all the desirable characters of the breed and must be able to transmit them to its progeny. The ram should have a muscular body, with a well-built head and heavy neck. It should have strong legs and sound feet. The chest should be broad and deep. The brisket should be wide and fleshy. The loins should be broad. The quarters should be thick and full.

A good ewe should be uniform in its body structure. It should have a long and low-set body, roomy hind quarters and a well-formed udder. It should be a good forager. It should have a strong motherly instinct and should have plenty of milk so that her lambs may grow fast and full.

For wool breeds, the ram should have a dense fleece of good quality. The lambs which have more of hair than wool should be rejected. Coarse, thick and chalky hair on the face and limbs indicate a hairy coat. Glossy, close, thin and transparent hair on the face and legs is a sign of good fleece. The space between the horns or on the top of the head should be free from stiff hair.

For mutton quality, lambs born early in the season should be selected, as they grow bigger than those born later. They should have more muscle than bone. Those lambs which attain good weight at the age of four to five months, yield more profits. The mutton from lambs at weaning age is of best quality.

For breeding, the flock should be divided into groups of 40 to 50 ewes each, with one ram to breed. Rams are able to serve females at the age of eight to nine months, but should not be used for breeding before they are 15 to 18 months old. Normally, a ram is in full vigour from the age of 2½ to 7 years. A well-bred ram can be used up to ten years of age. Young rams should never be allowed to serve more than 40 ewes during the breeding season. Rams of four to six years of age may be allowed up to 50 ewes. When rams are changed to a new place, they should be allowed to rest and get used to new surroundings before being put to service.

Ram-lambs in the flock should be castrated soon after they are weaned to avoid indiscriminate breeding. Early castration of ram-lambs improves the grains of the muscles, making them more tender and of better quality.

Ewes mature when about two years old. They should not be bred earlier. Ewes, as a rule, give birth to one iamb in a year. Twinning should be encouraged only when the flock can be provided with extra fodder and grain ration. The period of pregnancy in ewes varies from 142 to 152 days, with an average of 147 days. Unlike other animals, ewes generally do not come in heat throughout the year but are seasonal in this respect. They come into heat every 13 to 19 days, the average being 18 days during the breeding season. The period of heat in ewes lasts from 3 to 70 hours, with an average of 27 hours. The optimum time of mating is towards the end of the heat-period.

There are three well-defined breeding seasons in sheep: summer, autumn and winter. The lambs from summer matings grow well, because their mothers have had plenty of green-grazing available during pregnancy. Lambs born in winter are good when enough of field-grazing or remains of the monsoon crops are available. Lambs born in summer are generally a loss.

At the time of lambing, the ewe shows a characteristic vertical movement of the tail and usually lags behind the flock. She scratches the ground with front legs and constantly changes her position by standing and sitting.

In normal birth, the lamb presents itself with the head in between its front legs. Healthy ewes do not require any help at lambing. Normally, the lamb will be on its legs in a few minutes and reach for the teats. The lamb may be helped, if it is weak. In cold weather, the ewe and the new-born lamb should be kept in a warm place.

In indigenous sheep, lambs weigh two to four kilograms at birth. Exotic breeds produce lambs ranging from six to eight kilograms. The lambs grow quickly in the first three months. Lambs are generally weaned when 8 to 16 weeks old. At five to six months, lambs are ready for fattening for the market. At 18 months, the growth is complete. On an average, the weight of matured ewes ranges from 20 to 30 kilograms and that of rams from 35 to 45 kilograms. For obtaining good returns from the lamb-crop, it is essential to provide the mother with grazing facilities which are favourable for longer milk production.

Sheep milk contains more fat, casein and sugar than cow milk. Sheep milk is yellow in colour and the fat globules are large. On an average, its milk contains 5·15 per cent proteins, 6·18 per cent fat, 4·17 per cent sugar, 0·93 per cent minerals and 83·57 per cent water.

FEEDING THE SHEEP

Sheep thrive on natural grasses, herbs and farm wastes. Having a small muzzle, with a split upper lip, sheep can nibble at blades of herbage which are too small for bigger animals. Sheep do not like to graze on the same pasture continuously. A good practice is to graze flocks in a light soil in the morning and on fallows of heavier soils in the afternoon. The winter-dew on the grass should be avoided. In summer, sheep should be grazed on land where there is a hardy grass like *dub* or *kunda*. Normally, the quantity of fodder required by sheep varies from 2·5 to 5 kilograms of green material daily.

Sheep are generally not given any grain ration except when they are to be fattened for the mutton market. Stud rams would need 250 to 500 grams of concentrate ration daily during breeding season. A good grain ration for breeding rams can be prepared by mixing two parts crushed grain or *guar* seed, one part wheat bran and one per cent salt.

Fresh, clean water is essential for sheep to maintain good health. Unless forced to drink from stagnant pools, sheep will prefer flowing rivulets as the source of drinking water. The provision of permanent water-troughs which can be kept clean will greatly assist in keeping sheep healthy. Most of the major ailments of sheep are caused by dirty stagnant water.

GENERAL MANAGEMENT OF SHEEP

Sheep by nature are docile and obedient. They instinctively follow the leader. This habit is taken advantage of in herding them on fields and pastures.

Sheep unlike cattle and horses are generally reared in larger groups under natural conditions for the greater part of the year. Individual care in the case of sheep is neither economical nor feasible. It is, therefore, necessary that the various operations in the management of the flock should be carried out at times when climate, grazing and market conditions are most favourable.

Sheep love to live as natural a life as possible. They do not need any special facilities. They like living in the open with dry ground for bedding. They should, however, be provided protection during nights from wild animals and inclement weather. Ordinarily, a simple open pen fenced with dried, thorny *babul* branches and partially covered with thatched roof serves the purpose well. A floor space of one to two square metres per sheep should be provided.

SHEARING OF WOOL

Fleece provides natural protection for sheep against inclement weather. Shearing should, therefore, be done when the weather is neither too cold nor too hot. Chilly winds accompanied by driving rains will ruin the health of a newly-shorn sheep. Sheep are, generally, shorn either at the end of the rainy season or in the beginning of summer. In many places, the flocks are shorn twice a year.

Sheep are generally washed before shearing. They should, however, -be perfectly dry before starting shearing. The sheep should be sheared in a clean, dry place, free from dust. Different qualities of wool should not be mixed. The mixing of the hair from the legs, belly and the thighs lowers the quality of a fleece. The right type of shears with well-sharpened blades should be used to obtain a quick and uniform cut.

The wool fibres are valued according to their elasticity and uniformity. As a rule, the finer the wool, the shorter its length. The major portion of the wool obtained in India is hairy and coarse. The wool is generally coloured and is not suitable for making superior cloth. India is, however, considered the world's best producer of high-quality carpet wool. The annual yield of wool per sheep, in India, varies from 340 grams to 1800 grams, the average being 700 grams.

DETERMINING THE AGE OF SHEEP

The age of sheep can be estimated from their teeth. Sheep possess eight teeth and twenty-four molars. The teeth are only on the lower dental pad. A lamb has eight milk teeth in the suckling stage which appear within the first month of birth. The replacement of the milk teeth commences at the age of 12 to 14 months by the two central permanent teeth. At about 24 to 26 months, second pair of permanent teeth appear. At 36 months, third pair appears and the fourth pair of permanent incisors is formed at the age of four years. Thereafter the approximate age can be determined from the degree of wearing and discolouration of the teeth.

COMMON DISEASES OF SHEEP

Sheep suffer from a number of diseases. Most of the infectious diseases in sheep are caused as a result of poor management practices. Over-stocking, grazing on low wet lands, sudden change in environments and feed are some of the main causes of sickness in sheep. They also frequently suffer from parasites, both external and internal. The use of proper sprays, dips or dust are essential for the control of external parasites. Internal parasites can be controlled through proper pasture management and by keeping the sheep under hygienic conditions.

Signs of illness in sheep are not as easily discernible as in other domestic animals. Sheep keep on following their usual routine even when they are seriously sick. One can only make out a sick sheep by observing its movements very carefully. The most characteristic signs of illness in sheep are high temperature, stopping of rumination, hard breathing, coughing, sneezing, diarrhoea and drooping gait. In sheep, the infection spreads very quickly due to their flocking habit and, therefore, needs immediate attention.

The normal temperature of healthy sheep is 39·4 degrees C (103 degrees F). The pulse-rate varies from 68 to 90 and the respiration-rate from 20 to 30 per minute.

The most common contagious diseases of sheep are haemorrhage septicaemia, anthrax, sheep pox and black quarter.

Haemorrhage septicaemia is a highly contagious disease in sheep. The disease causes rapid deaths in quick succession in the flock. The main symptoms are difficult breathing, with a rasping noise, high temperature, severe diarrhoea and swelling at the throat.

To prevent the disease, general prophylactic measures should be adopted. The affected animals should be immediately segregated. Sheep should be vaccinated against the disease.

Anthrax is a deadly contagious disease in sheep. It is communicable to human beings. Persons working in wool factories may get it through breathing. The infection is also carried through wounds. The main symptoms of anthrax are high fever and swelling of the throat and tongue. The animal dies soon after infection, generally within six hours.

Preventive measures include isolation of affected animals, proper disposal of carcasses, and pre-seasonal vaccination against the disease.

Sheep pox is a common disease, endemic to certain areas. It is generally fatal in lambs. The chief symptoms are the appearance of pustules on the mouth, between the hind legs and udder, high temperature and loss of appetite.

Preventive inoculation, segregation of affected animals and adoption of hygienic measures are recommended.

Black quarter is a common disease in sheep. It is generally caused from an infection occurring after a shearing wound or parturition. High temperature and lameness are the chief symptoms of this disease.

Preventive inoculation is the only remedy as the affected animals do not generally respond to any treatment.

III

GOATS

INTRODUCTION

THE goat is known as the poor man's cow all over the world. In Switzerland, the milch goat is said to be the Swiss baby's foster-mother. The goat is an animal that adapts itself readily to almost any climate. It is hardy, prolific and can be cheaply reared. The goat eats a class of fodder on which other animals would starve, and for that reason, goat-rearing is followed as an occupation by a large section of landless labourers in rural areas.

Goat's milk is highly wholesome and nourishing. It is considered specially suitable for invalids and infants on account of its easy digestibility. India produced 777 metric tonnes of goat milk in 1974-76.

The goat is the major supplier of meat in India. Goat flesh is preferred to other meats. Goat flesh also fetches a better price than mutton and beef in most of the urban markets. India produced 274 thousand metric tonnes of goat flesh in 1959-60, valued at 464·8 million rupees.

Goat skins are in great demand for leather for gloves and shoes. 30·3 million goat skins were produced in 1959-60, valued at rupees 131·7 million. *Mohair* from Angora goats and *Pashmina* from Kashmiri goats are greatly valued for the manufacture of superior dress fabrics and shawls. 4,516 metric tonnes of goat hair were produced in India in 1959-60, valued at 11·9 million rupees at current prices. The intestines of goats are used to make *catguts*. Goat hair is used for rope-making.

The goat has a habit of nibbling the buds of trees and of foraging on nearly any variety of plants. For this reason, it is considered a great enemy of vegetation, bringing about the erosion of soil. This destructive habit is, however, mainly due to wrong management practices. Adoption of correct practices for their care can bring about desirable change in their feeding habits.

Against the total world population of 416 million goats, there were 75.6 million goats in India in 1977. There were 67.5 million goats in 1972. There has been an increase in the number of goats : 8.9 per cent in 1977 over that of 1972.

Statewise, the goat population in 1977 was 4.36 million in Andhra Pradesh, 1.65 million in Assam, 9.92 in Bihar, 3.08 million in Gujarat, 0.55 million in Haryana, 1.03 million in Himachal Pradesh, 0.69 million in Jammu & Kashmir, 3.38 million in Karnataka, 1.68 million in Kerala, 6.72 million in Madhya Pradesh, 7.56 million in Maharashtra, 3.41 million in Orissa, 0.72 million in Punjab, 12.30 million in Rajasthan, 4.20 million in Tamil Nadu, 8.46 million in Uttar Pradesh, and 5.21 million in West Bengal.

IMPORTANT BREEDS OF GOATS

There are several distinct breeds of goats in India. The most important of them are Kashmiri, Gaddi, Chamba, Pashmina, Jamnapari, Beetal, Marwari, Osmanabadi, Barbari, Malabari and Bengal.

Kashmiri goats are found in the hilly tracts of Kashmir and Tibet. They do not usually thrive in a damp climate or in the plains. They can withstand a very severe cold weather. Generally, their colour is white or black and white. They have long curved horns and long ears. Their body is covered with fine silky hair, beneath which is a fur-like undercoat of great fineness and warmth called *pashmina*. The undercoat grows during winter months and is shed in spring. The goats are combed for eight to ten days and the undercoat collected, leaving the long silky hair to be clipped later. The long hair are commonly used for making ropes and *numdas*. These goats are commonly used as beasts of burden and for meat. Their milk yield is very low.

Gaddi and *Chamba* goats are found in the Himalayan ranges in the neighbourhood of Kangra Valley in the Punjab, Chamba, Sirmur and Simla in Himachal Pradesh. These breeds are well built, sturdy and able to walk long distances. These animals have a tapering muzzle, alert eyes, a well-cut Roman nose and long drooping pointed ears. The horns are pointed at the apex, bending upwards and backwards. They have a coarse long hairy coat. The colour is mainly white, but grey and red are also met with. These goats have a small but well-set udder, and pointed teats. Their meat is coarse and devoid of fat.

Pashmina goats are mostly reared in Ladakh, the Lahaul and Spiti valleys of the Punjab and the Chini valley and its neighbouring areas of Himachal Pradesh. Large herds of these goats are found in the Changthang area at elevations of 12,000 to 14,000 feet.

Pashmina goat is a small dainty animal with quick movements. It has a level back with very little droop in the croup. The ears are long and pendulous. The coarse hair cover the major portion of the face. The longer and finer *pashmina* is grown on the sides and shoulders. The majority of goats are white in colour, but brown and grey are not uncommon. In hills, these goats are used for transport, particularly at higher altitudes.

Jamnapari is mainly bred in areas lying between the Ganges, Jamuna and Chambal rivers. Pure specimens are found in the Etawah district of Uttar Pradesh. They are dual-purpose goats, combining meat and milk qualities. They are hardy and active and thrive well under rough village conditions.

These goats are probably the most handsome of the Indian breeds. They have a large body, short, flat horns and long, wide, pendulous ears. They have a pronounced Roman nose. They possess large udders with big teats.

Beetal breed is mainly found in the Punjab. It resembles the Jamnapari breed but is smaller in size. These goats are prolific. They give appreciable quantities of milk. They are fond of browsing and thrive well on range.

Beetal goats have long, pendulous, flat ears and a Roman nose like that of Jamnapari. The horns are curved with a tendency to grow outward. Generally, the male goats possess a well-defined beard. The usual colours are red and tan, often heavily spotted on white.

Marwari goats are bred in the Marwar area of Rajasthan. They are hardy and disease-resistant. They are popular for their meat.

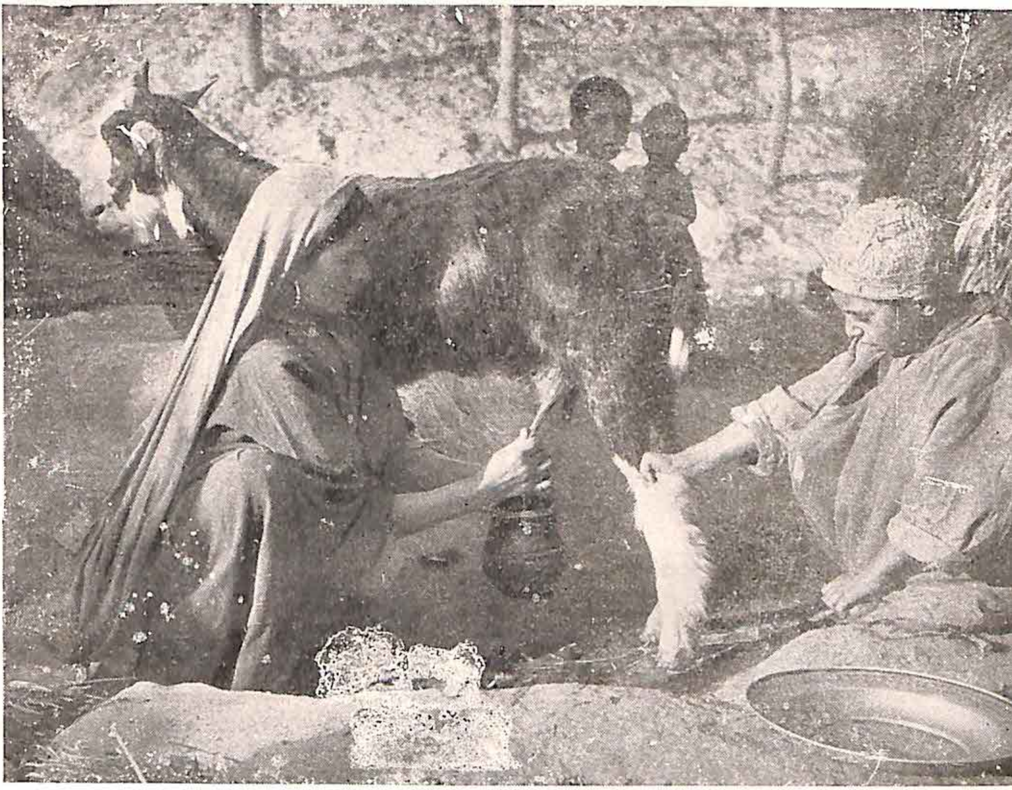

Fig. 7. A Goat is Very Much a Part of the Family (Kashmir Valley)
(*See page 47*)

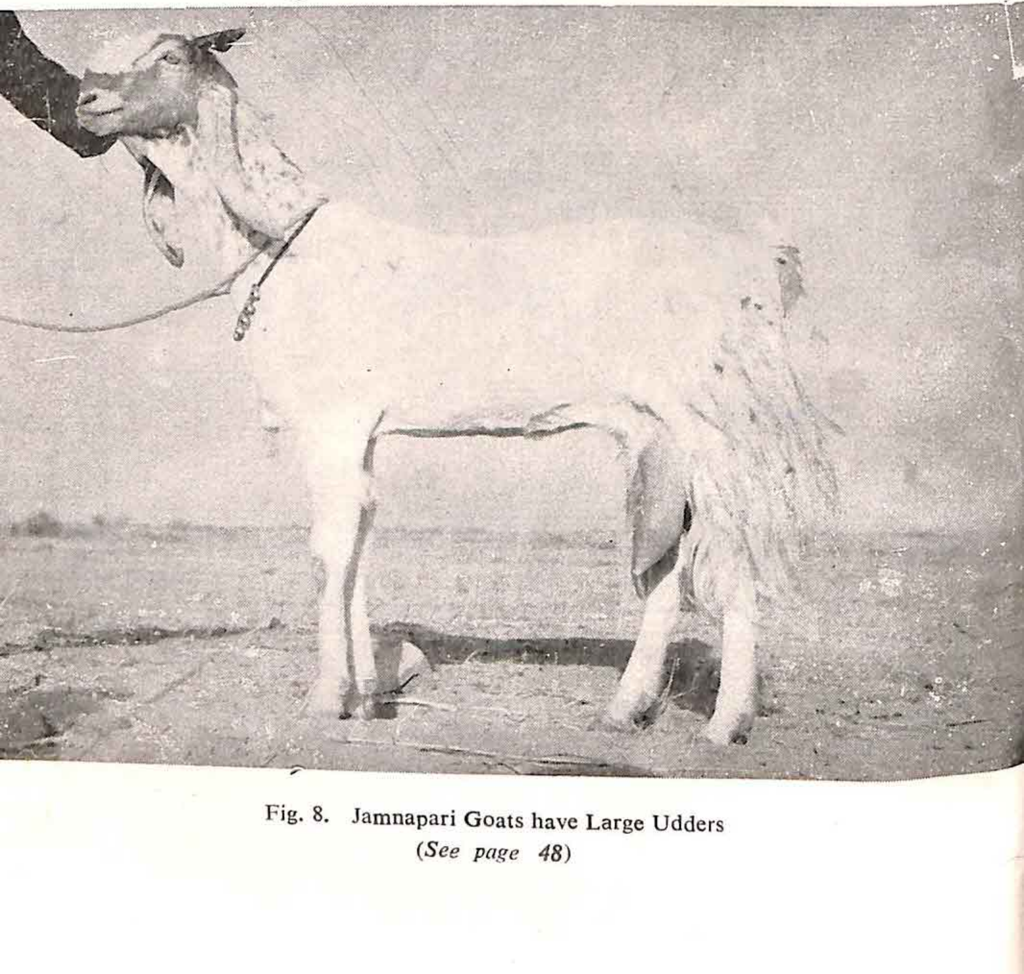

Fig. 8. Jamnapari Goats have Large Udders
(*See page 48*)

Marwari goats are medium-sized, having a small muzzle with a stout nasal bone. The neck is heavy, the ears are flabby, the horns are twisted and pointed. The jaw carries a thick beard. The tail is curved upwards with a tuft of raised hair. The hair of the body are jet black and lustrous.

Osmanabadi breed of goats is met with mainly in the Osmanabad district of Andhra Pradesh. These goats are large in size. They are considered useful both for milk and meat. They have long horns and the common colour is black, although a mixture of white and black or red is also met with.

Barbari breed of goats is supposed to have originated in the city of Berbera in British Somaliland in East Africa. In India, these goats are found in the towns of Uttar Pradesh such as Etawah, Etah, Agra and Mathura. It is primarily a milch type breed. Its small size makes it unsuitable for meat production. A Barbari goat makes an ideal family pet, as she is small in size, clean in habits, docile and can be stall-fed. These goats are very prolific.

Barbari goats have slender, small and erect ears. They have short legs with strong and fine bones. They have a very fine coat of short and silky hair. They carry a well rounded udder with medium-sized teats. They are not bred to any standard colour and are generally spotted with fawn, red, tan or black spots.

Malabari goats are mainly met with in Malabar in North Kerala. This breed seems to have been derived from the goats brought by Arab merchants centuries ago by crossing them with local goats.

These goats have an attractive appearance. The head is of medium size with a flat and sometimes Roman nose. The ears are long. They have no uniform colour, but the white with black coloured patches is common. They have a well-developed udder. There is a class of these goats which has no horns.

Bengal goat has been known in Bengal since time immemorial. This breed is known for its mutton of excellent quality. The milk yield is very low.

Bengal goats are very small in size. The body is deep, the back is straight and the shoulders and hip are of equal height. The chest is wide and the legs are short. The ears are nearly upright.

These animals have a dark black colour. The skin is of very superior quality and is in great demand both in India and abroad.

The important foreign breeds of goats which have been introduced in India and are doing well are Toggenburg, Alpine, Anglo-Nubian, Saanen, and Angora. The bucks of these breeds are in great demand for the upgrading of local goats.

Toggenburg is a large goat known for its high milk-yield. It is of fawn shade with white or cream markings. The *Alpine* is similar to Toggenburg but is black in colour. The *Anglo-Nubian* is Asiatic in origin and has large hanging ears. The coat is short, fine and glossy. The *Saanen* is a large goat, and is noted for its high milk-yield. Commonly, its colour is white or cream. *Angora goats* originated in Asia-Minor and Turkey. These goats are well known for production of *Mohair*, which is a valuable raw material used for manufacture of superior woollen cloth. Mohair is fine in texture and lustrous in appearance. It hangs loosely from the body of these goats in long white spirals or ringlets.

SELECTION OF MILCH GOATS

A good milch goat should have a long, deep and wedge-shaped body. The animal should appear active and healthy, with large bright eyes. The neck should be long and slim. From a point just behind the forelegs, the stomach should drop in a gentle curve, rising again slightly to the point of contact with the udder, below the hips. The ribs should be well-sprung. The legs should be straight, strong and possess good bone. The skin should be soft and shining.

The udder should be long, extending below between the thighs and carried forward along the belly. It should be well-attached to the body. The udder should have a soft and spongy texture. It should collapse and reduce greatly in size after milking. Teats should be of medium size, uniform and sloping slightly forward and not outward. The milk-veins should be large and prominent.

A good buck should be masculine and virile in appearance. It should have a large, long and deep body. The chest should be prominent and broad, with ribs well-sprung. Hocks should be well apart. The scrotum should be well-developed. It should hang high and should not be pendulous. The legs should be straight and the feet strong. A sire, whose dam is a poor milker, should not be used as a stud for milch goats.

BREEDING OF GOATS

Goats have a tendency to mature at an early age. The best age to mate is, however, 15 to 18 months and should kid for the first time when they are about two years old. Male kids show considerable sexual vigour very early. Therefore, the two sexes should be kept separate from the age of two or three months. The male is considered at his best for stud purposes, when two to three years of age. But it can be used as early as 12 months of age on a limited number of goats. A well-built mature buck can serve from 75 to 100 females a year, provided he is kept in a good healthy condition. A good male keeps fit for breeding till about ten years of age. The goats reach their maximum efficiency at the age of five to seven years. The average life span of a goat is about twelve years.

A goat comes into season about six to eight weeks after parturition and will continue doing so at an interval of 18 to 21 days till it conceives again. Although certain breeds of goats, such as Barbari, can easily be bred twice a year, it is better to have one kidding in a year, as the kids keep better health and the lactation period is prolonged.

The general signs of heat in goats are like those in cows and buffaloes. The doe in heat becomes very restless, shakes its tail, keeps bleating in a peculiar way and goes off her feed. There is a considerable swelling and reddening of the genital opening. There is a sudden drop in her milk-yield. She tries to break loose.

The heat period in goats lasts from one to three days in summer. During winter, its duration is of 24 to 36 hours only. Goats which are shy breeders pass their heat period unnoticed, and do not show any other signs except a slight redness of the genital opening. Such goats should be watched carefully. For the best results, the goat should be mated between the tenth and fifteenth hour after the first appearance of the signs of heat. During the normal breeding season, one service is generally enough. The normal period of gestation in goats varies from 145 to 152 days. The average is 150 days.

The signs of pregnancy generally do not appear till two and a half months after mating. A few days before parturition, the udder begins to enlarge and mammary glands show signs of activity. Sometimes, heavy milkers have to be milked several times before the kid is born. A few hours before kidding, the flanks become hollow. There is redness and swelling of the genital opening from which there is a slight discharge. The goat bleats and paws the ground. The goat gives birth while lying down. The normal kid comes out with the head laid on the front feet. In normal delivery, the whole thing is completed in about 45 minutes.

The mother cleanses the body of the new-born kid by licking. The thin membrane covering the nose and mouth of the kid should be wiped off with a clean cloth. The navel of the kid should be disinfected properly.

Normally, the kids get on their legs within a few minutes after birth. Care should be taken that milk from both the teats is drawn evenly and completely. The kids are generally weaned at the age of about three months. Weaning of kids at birth is common in foreign countries. It is considered a more hygienic and better method of rearing kids. Weaned kids can be fed milk from a bottle like human babies.

Goats have long lactation periods. But it largely depends upon the breed, the condition of the animal and the level of feeding. To obtain a long lactation, the goats should not be bred soon after kidding. They generally go dry by the time they reach the middle of their pregnancy.

As compared to the milk of other animals, goat's milk approaches nearest to human milk in fat percentage and proteins. Its sugar content is slightly less and ash content more than in human milk. Due to its superior digestibility, it is widely used for babies, invalids and convalescents. Goats are remarkably free from tuberculosis and their milk is considered very safe. An average sample of goat's milk contains 3·76 per cent proteins, 4·07 per cent fat, 4.64 per cent sugar, 0·85 per cent minerals and 86·88 per cent water.

Many people have a prejudice against goat's milk due to its peculiar flavour. This can, however, be easily overcome if the goats are kept under clean and hygienic conditions away from the buck. The buck must not be allowed to mix with milch goats. It is the buck which emits the objectionable goaty odour, specially during the breeding season.

FEEDING THE GOATS

Goats have peculiar feeding habits. They are constantly in search of a change in their feed. Goats prefer browsing on small bushes and flourish on loppings of trees. They especially relish leaves, twigs, and tender buds of mulberry, *neem*, *ber*, *babul*, and tamarind. They also enjoy grazing on fresh pastures. Goats are fastidious about the cleanliness of their feed. A goat will not eat fodder which has been trampled under foot.

When goats are entirely stall-fed, three feedings, one each in the morning, at mid-day and in the evening, should be provided. Different varieties of feeds during the day suit nature of the goats. No hard and fast rule can be laid down as to the quantity of fodder that may be fed to a goat. It should have as much as it is able to clear up eagerly at one time. The average goat requires about 3·5 kilograms of green fodder a day. A part of it may be substituted with dry fodder such as dry leaves or the hay of leguminous forage crops. A goat in milk, as a rule, should get an additional ration of about 500 grams of concentrate mixture consisting of gram, wheat bran, husk, or oil-cake. Pods of the *babul* tree and *pala* or *jhar beri*, a shrub found in the dry tracts, are commonly used as substitutes for concentrates. High milk-yielders will need an extra concentrate feed. Pregnant goats should be given about 225 grams of grain ration daily during the last two months of pregnancy. Stud bucks should be given daily 500 grams of grain mixture during the breeding season.

Goats should be fed at regular hours. The feed for goats should always be fresh and clean. Any change in the feed should be made gradually. In early monsoon, they should not be allowed to feed very much on new and tender grass. Goats do not like wet fodder.

Minerals constitute an essential part of the goat's ration. The most important minerals required for feeding goats are calcium and phosphorus. These can be made available to goats by including bone-meal in their feed. Stall-fed animals should be given small quantities of common salt with the daily ration.

A suitable ration for feeding goats can be prepared by mixing one part wheat bran, two parts maize, and one part linseed cake or two parts gram and one part wheat bran. All cereal grains should be crushed and oil-cakes finely ground before feeding.

Goats, by nature, are not heavy drinkers of water. Many goats hardly ever drink water, if they have plenty of green feed. But to keep the animals in proper health, they should be offered fresh clean water, both morning and evening; and at mid-day during summer months. Goats love to drink water from a running stream.

HOUSING OF GOATS

Under village conditions, goats generally do not require any special arrangements for housing. They, however, should be protected against bad weather, wild animals and pests. Goats are generally susceptible to cold and should be kept in a comfortable and warm place, especially during winter months. As a rule, the houses for goats need not be very expensive. They should, however, be clean, well-ventilated and free from draught and dampness. The place should be always kept properly drained.

The kids should be kept in warm houses, especially in chilly weather. The buck should be housed away from the milking goats to avoid the peculiar odour which is usually associated with the goat's milk.

GENERAL MANAGEMENT

All male kids, not required for breeding purposes, should be castrated at a young age, preferably before they are ten to twelve weeks old. A small-sized Burdizzo castrator, especially meant for sheep and goats, is the best for the operation, as its use does not require much skill or experience. Castrated males rapidly put on body-weight and do not emit goaty smell. Castration also improves the quality of meat.

Goats are milked twice daily, but the interval between the morning and evening milkings, as far as possible, should be equal. Milking is done by the milker by sitting either behind the goat or on its left side. The latter is a more convenient and cleaner practice. Goats should be milked gently, quickly and thoroughly. Both the teats should be uniformly milked. Thorough cleanliness should be observed. Before milking, the milker should wash his hands properly and the udder and teats should be wiped with a clean damp cloth. The milk vessels should be clean and properly washed. The milking place should always be kept clean and dry.

Flocking instinct in goats is very much less marked than in sheep and for that reason, more care is needed to see that they do not stray from the flock while on the move or grazing.

A goat should be groomed every day with a soft brush. It keeps the animal clean and imparts a glossy appearance to its coat. Grooming also stimulates blood circulation and promotes health.

Bucks of those breeds which have long hair are generally trimmed. This helps to keep them clean. Their face and front legs should be washed daily as they are usually in the habit of passing urine over their face and front legs.

When goats are confined to stalls, their feet require special attention. The hoofs should be trimmed down carefully at least once a month to the level of the sole by means of a hoof clipper.

COMMON DISEASES OF GOATS

Unlike other domestic animals, goats are comparatively less prone to serious diseases. Parasitic infection in goats, however, is fairly common and often it is responsible for heavy mortality.

The general signs of ill-health in goats are dullness, high temperature, quick respiration and pulse-rate, partial loss of appetite, cessation of chewing, and sudden decrease in milk-yield.

The normal temperature of a goat is 39·4 degrees C (103 degrees F). The average pulse-rate varies from 68 to 90 and respiration from 20 to 30 per minute.

The most common contagious diseases of goats are anthrax, goat pox, pleuropneumonia, and foot and mouth disease.

Anthrax is a serious disease which is common in goats. The course of the disease is very quick and sudden. Animals generally die within a few minutes of infection. The affected animal develops a high temperature. In acute forms, it causes an unsteady gait, trembling, difficult breathing, blood discharge from the natural body openings and convulsions.

The preventive measures include vaccination against the disease, ploughing up of the infected pastures and leaving them open for about two months. The carcasses of dead animals should be burnt or buried deep after covering with quick-lime. As the disease is communicable to human beings, proper precautions must be taken in handling the affected animal.

Goat pox is a highly contagious disease, fairly common among goats. Its chief symptoms are rise in temperature, and appearance of pimples followed by vesicles, usually on the inner surface of thighs, on the udder, teats and under the tail. The man who milks the goat may also get sores on his fingers.

The affected animals should be segregated. Their milk should not be used for human consumption. The premises should be thoroughly disinfected and all scales falling to the ground should be burnt.

Contagious pleuropneumonia is an infectious disease characterised by pneumonia and pleuritis. It is a serious specific disease of the goats and affects them at all ages.

The affected animal develops cough and sneezing. Breathing becomes difficult and there is increased nasal discharge which is sometimes tinged with blood.

Preventive measures comprise segregation of affected animals and vaccination against the disease.

Foot and mouth disease usually appears during the rainy season. The disease rapidly spreads among goats. It is characterised by the formation of blisters on the mucous membranes of the mouth and on the skin between and above the cleft of the feet, smacking of lips, salivation and lameness. At times, it is accompanied by diarrhoea and pneumonia.

The affected animal should be isolated. The lesions in the mouth and foot should be properly treated. The movement of flocks should be restricted.

IV

PIGS

INTRODUCTION

AMONG domestic animals pigs are the most prolific breeders and quick growers. A unit of ten sows and one boar will produce over 160 piglets during the first year.

Pigs can make a full and efficient use of the cereal by-products. Pigs require much less feed for each kilogram of gain in body-weight. Pig meat has a great demand in the manufacture of products such as ham, bacon and sausages.

Pig-rearing can give quick returns with a low investment. Pigs yield a higher percentage of dressed carcass. Pork is well-known as a high quality protein food and is higher in energy-content than other meats.

PIG-RAISING IN INDIA

Pig-raising and pork industry, in India, are in very primitive stage. Pig-rearing is almost entirely in the hands of backward classes and poor people with little resources. They continue to follow old and primitive methods.

The common village pig in India is scrub animal and has no definite characteristics. It is a slow grower and the pork is of very low quality. It is small-sized and produces small litters. Under the prevailing conditions of management, the country pigs are mostly neglected. They do not get a fair chance to grow into economical animals. In recent years, however, a number of piggeries have come up in the country, where pigs are reared on improved lines and the manufacture of products is carried out under modern conditions.

In India, there were 7.6 million pigs in 1977. This showed an increase of 0.7 million over those in 1972 and 1.86 million over those in 1966. According to the Livestock Census, 1972, there were 6.9 million pigs, which showed an increase of 4.2 per cent over that of 1977.

In 1977, there were 9.64 million pigs. Of these Andhra Pradesh had 0.8, Assam 0.5, Bihar 0.9, Madhya Pradesh 0.4, Tamil Nadu 0.7. In the United States, pig production is a big business. In 1972, 93.7 million heads, valued at 5.4 billion dollars were produced. This represented about 20 per cent of the total world production. China leads the world in hog production.

EXOTIC BREEDS USED IN INDIA

Improvement of the country pigs, in India, is generally sought through upgrading by the use of the boars of some of the exotic breeds. This has given very encouraging results with the minimum outlay. The imported breeds which have been commonly used for upgrading are Large White Yorkshire, Middle White Yorkshire and Berkshire.

Large White Yorkshire pigs are natives of Northern England and are raised in large numbers in Canada, Scotland, Ireland and the United States of America. It is a prolific type of pig, and gives very large litters. In India, it is a popular breed used for improving and upgrading of country pigs. It has, however, proved more suitable under controlled conditions of feeding and care than under ordinary village conditions.

Large White Yorkshire breed is white in colour. It is extremely long and deep and is firm fleshed. The ears are thin, long and slightly inclined forward and fringed with fine hair. The neck is long and full to the shoulder with deep and white chest. The back is long, level and faintly white. The sides are deep with well-sprung ribs. The legs are straight and well set. The weight of mature boars is about 300 to 400 kilograms, while the average sow weighs from 220 to 320 kilograms.

Middle White Yorkshire is an English breed which is said to have been evolved by crossing the Large White with a smaller breed of Yorkshire extraction. Middle White is early maturing and well known producer of high-class pork at comparatively low cost. It yields a high percentage of dressed carcass. It is a hardy breed and does well on grazing. This breed has been found more suitable to thrive under Indian village conditions as compared to other exotic breeds.

This breed is white in colour, the neck is full to shoulders, which are wide. The back is long and level. The humps are broad, full and deep to hocks. The sides are deep and level with well-sprung ribs. The flanks are thick. The quarters are long and wide. Boars of this breed, when fully grown, weigh about 250 to 350 kilograms. The weight of an average sow varies from 175 to 275 kilograms.

Berkshire is one of the oldest English breeds of swine. This breed is very popular in Australia and New Zealand. It is valued as a producer of meat, especially suitable for the pork market. It carries comparatively a high proportion of lean meat and is not considered very suitable for the manufacture of products, especially bacon. In India, Berkshire boars have been largely used for upgrading in the South.

Berkshire breed is black in colour with white markings usually on the feet, head and tail. It has short head with dished face. The snout is short. The body is long and ribs well-sprung. A full-grown boar weighs about 275 to 375 kilograms and an average sow weighs from 200 to 300 kilograms.

The other important breeds of pigs of British origin are *Tamworth, Essex* and *Wessex Saddleback. Chester White, Duroc,* and *Hampshire* breeds are popular in America.

SELECTION AND MANAGEMENT OF BREEDING BOARS

The breeding boar, being the most important member of the herd, should be selected with care. A good breeding boar should be masculine in appearance. It should conform to the breed type. The body should be of good length and the shoulder should not be too heavy. The boar should have no physical defects and both its testicles should be palpable in the scrotum.

Young boars, not selected for breeding, should be castrated when three to five weeks old, before they are weaned. The castrated piglets develop better. Castration also prevents the development of the strong flavour often associated with the pork of uncastrated animals. The operation should be done quickly and hygienically. Castration should not be done during warm weather, especially when flies are around. The piglets should be kept on light feed for about 12 hours before castration and should not be disturbed after the operation for the rest of the day.

Young boars, if properly fed and maintained, are generally fit for service when they are about eight months old but they should be sparingly used until they reach the age of one year. A boar will normally give satisfactory service till it is about six years old. The breeding boar should be allowed only 50 sows in a year. Ordinarily more than one service should not be allowed in one day, prefarably not more than 20 services in a month. If put to heavy strain for a long time, boar may lose condition and produce weak and smaller litters.

The boar should not be allowed to run with the sows. This practice leads to the boar exhausting himself unduly by giving a sow more than the necessary number of services. When the sows come into season, the boar should be allowed to serve them once. Boars are often temperamental and may not serve in unaccustomed surroundings. Repeated failures in service may lead to the boar's complete refusal to serve even when the sow is fully on heat.

To keep a boar healthy and vigorous, care should be taken to avoid over-feeding. The boar should receive a regular supply of green feed and a reasonable amount of exercise. Sometimes, improper feeding and bad management result in sterility of the boar.

SELECTION AND MANAGEMENT OF BREEDING SOWS

The breeding sows should be selected when young from a mother known to rear consistently large litters of uniform piglets of high weaning weights. She should be able to produce a litter of fair size, in good health and growth. Normally, a litter in which the piglets are uniform in size, is considered a better commercial proposition than one consisting of piglets of varying sizes.

The breeding sow should be long and deep in the body, well-fleshed down to the hocks, and free from any abnormality. She should have proper mammary development with twelve to fourteen teats evenly distributed on the two sides of the belly. Sows which have defective teats and are poor milkers, should not be selected for breeding. Breeding sow should have a quiet disposition. Nervous and irritable sows are seldom good mothers. The sow should have a good feminine appearance and should not have thick, coarse head and ears. It should neither be too fat nor run down in condition. Sows that get unduly fat often fail to become pregnant. In such cases they should be given less feed and preferably kept on grazing. Gilts, generally, put on fat when they are about eight to nine months old. During this period, the concentrate feed should be reduced. Sows in poor health are usually irregular in breeding and produce smaller litters of poor health.

A young gilt reaches full maturity when about two years of age. If looked after well, they may be breed for the first time at the age of about nine months. Breeding of gilts at too early an age should, however, be avoided to enable them to develop properly and produce healthy litters. On the other hand, breeding of gilts should not be too much delayed since the animals are liable to become fatty, and develop sterility.

Generally, there are two seasons for breeding pigs, August-September and February-March. Liberal feeding during these periods helps in bringing the sows to heat early.

The young gilt shows the signs of first heat when she is about four to six months of age. Heat recurs at intervals of twenty-one days until they become pregnant. Sows, after farrowing, come into heat between five to seven days after the litter is weaned. The sow should be served at this time. The heat period lasts from 40 to 65 hours, being longer in the sow than in the gilt. The best time for service is towards the end of the heat period rather than in the early stages.

The usual indications of heat in a sow are loss of appetite, restlessness, heavy or enlarged vulva, and a light mucous discharge. The sow frequently mounts on other sows and occasionally makes peculiar loud grunting sound.

The gestation period in sows varies from 112 to 116 days, the average being 113 days. Two litters may be obtained in a year under proper conditions of feeding and management.

During pregnancy, it is essential to give the sow regular exercise. She should preferably have access to pasture in order to maintain her in good health.

In India, artificial insemination in swine breeding has not so far been practised on any appreciable scale. However, in some of the countries advanced in swine breeding, rapid progress is being made in the use of artificial insemination.

CARE OF SOW AT FARROWING

The sow should be removed to a separate pen about ten to fifteen days before the expected date of farrowing. The farrowing pen should be comfortable and connected with open yard where the sow and piglets can move freely. She should be provided plenty of clean bedding of dry straw. Most sows farrow within 24 hours after milk develops in the nipples. Farrowing usually takes between two and five hours but occasionally longer. Farrowing should be allowed to proceed with the minimum interference. In case of difficulty, veterinary aid may be provided. At the time of farrowing, the sow keeps lying down. The after-birth should be removed as soon as it is dropped to prevent the sow from eating it. The navel cord of the young ones should be ligatured about two centimetres from the body and cut off one centimetre below the ligature and tincture of iodine applied. The sow should be left undisturbed after farrowing. Necessary precautions should be taken to protect the mother and the young ones from cold. A bedding of dry straw should be provided during the winter season.

The sow should be maintained on a light diet for the first three days after farrowing. Thereafter she should be given normal feed as her appetite improves. The ration may be given moist or in the form of a thick slop. There should always be an ample supply of clean drinking water.

CARE OF PIGLETS

The most critical period in the life of a pig is its first three days. Approximately half of the losses of young piglets occur during this period and about one-third of the pigs that are farrowed fail to reach a weaning age of eight weeks. Although the chief cause of mortality among young piglets is overlaying by the sow, a good number of them die because they do not receive sufficient milk and other feeds.

Proper feeding of the sow before and after farrowing is no doubt the most important factor in ensuring that baby pigs are well endowed at birth to face the hazards awaiting them. A sow, when fed a good ration, may produce from three to four kilograms of milk per day. The composition of the milk of the sow is especially suited to meet the requirements of fast growing litter. Its milk is richer than that of the cow, especially in proteins and minerals. A sow's milk contains 7·23 per cent protein, 4·55 per cent fat, 3·23 per cent sugar, 1·05 per cent minerals and 83·94 per cent water. The sow must receive feeds containing these nutrients in sufficient amount to produce the milk required by the litter.

Normally, piglets stagger to their feet within a few minutes of their birth and find their way to the udder. As more piglets are born, there is competition for the teats, but eventually each piglet adopts one teat from which it sucks throughout the period. The teats nearest the fore limbs give more milk than those nearest the hind limbs. The piglets sometimes fight among themselves to secure the fore teats. In case the number of piglets in a litter is larger than the number of good teats, the stronger ones should be transplanted to another sow who might have farrowed about the same time but may have a smaller litter. Piglets must get colostrum as their first feed. This is secreted by the sow for three or four days after farrowing.

Piglets grow very fast during the first eight weeks of their life and, therefore, should always have plenty of food in front of them.

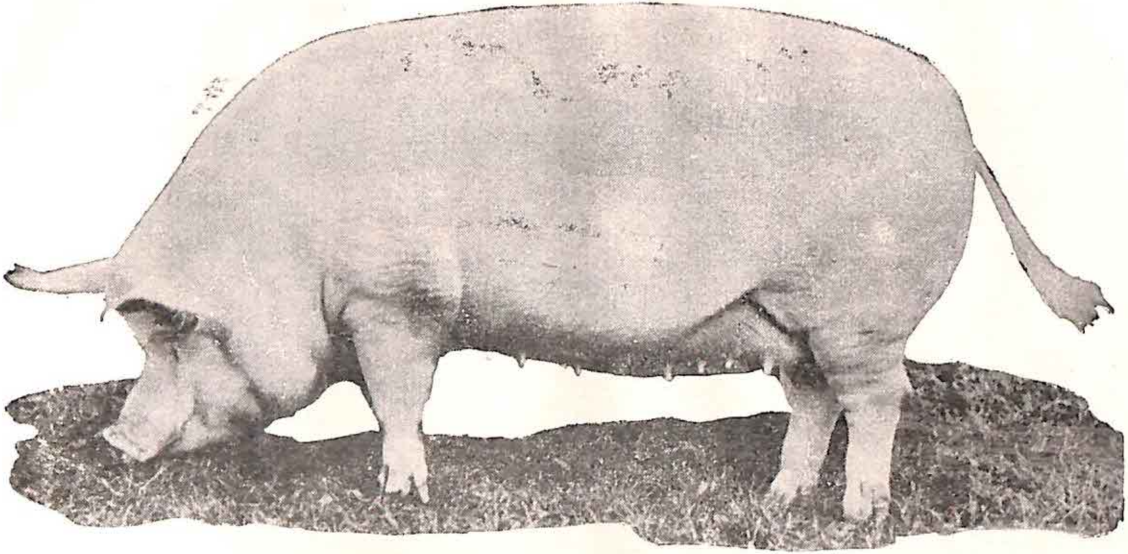

Fig. 9. A Large White Yorkshire Sow—They are Proliec Breeders
(See page 59)

Generally, the piglets are weaned at eight weeks of age. But by liberal feeding it is possible to wean them earlier.

EXERCISE

For the proper health and growth of pigs, plenty of exercise is necessary. In the case of fattening stock, however, exercise should be restricted to the minimum necessary to keep the animals healthy. The best practice is to allow the animals to run about in the open paddocks or to take them to pasture everyday for a few hours.

FEEDING THE PIGS

Generally, adequate attention is not given to the proper feeding of pigs in India. They are left to themselves to pick up whatever food they can find in the refuse heaps or in the harvested fields. This does not provide them any nutrition and adversely affects their health resulting in low returns.

Pigs, unlike cattle or sheep, have a simple digestive system and are consequently unable to digest efficiently coarse fibrous fodders. They should be given feeding stuffs of comparatively low fibre content such as cereal grains and their by-products. These are, however, deficient in respect of protein and minerals and do not provide sufficient nutrients to meet the requirements of growing pigs and pregnant or nursing sows. They should, therefore, be supplemented by other feeding stuffs which make good these deficiencies.

As in the case of all domestic animals, overfeeding should be avoided. Overfeeding is not only wasteful, but is likely to create digestive disorders and render a pig more susceptible to disease infections. The practical way to check this is to see that the feeding troughs are cleaned up in reasonable time after each feed.

The nutritive requirements of pigs vary for different purposes. The growing stock needs more of proteins for the repair of tissues, minerals for the building up of bones and vitamins for a healthy growth. Mature pigs need more of starchy food for energy and to put on fat.

Pigs need plenty of clean, fresh water. Depending upon the season and the nature of feeds, sufficient fresh water should be made available. Normally pigs require two to three litres of water per kilogram of concentrates. In feeding succulent feeds, care is necessary to ensure that excessive quantities of water are not consumed by the animals in satisfying their appetite. The distended abdomen of many poorly kept pigs is due to the consumption of excessive amount of water in the vegetable portion of the diet. It is advisable that food should be offered to the pigs in the form of a thick slop.

A liberal supply of drinking water is especially important in the case of nursing sows.

MINERAL DEFICIENCY

Growing pigs are often stunted and show slow growth because of deficiency of mineral matter in their feed. Brood sows frequently break down due to the same cause, when suckling their litters. Pigs, therefore, should always be provided with liberal quantity of minerals to meet their body-requirements, especially during growth and pregnancy.

The most important minerals in feeding pigs are calcium, phosphorus and salt. Ground limestone is an excellent source of calcium, and steamed bonemeal supplies both calcium and phosphorus. A good mineral mixture for feeding pigs can be prepared by adding steamed bonemeal five parts, ground limestone 2.5 parts, charcoal one part, hardwood ash one part and common salt half a part. To make up the deficiency of iodine in the goitrous regions, potassium iodide at the rate of 20 grams to each 100 kilograms of the mineral mixture should be added.

The best way of providing mineral mixture is to place it in wooden boxes kept in a dry place to which the pigs have access at all times. The required quantity of mineral mixture can also be added to the green ration. In the first method, it is desirable to place only limited quantities of mineral mixture in the wooden boxes in the beginning to avoid over-eating by the pigs. Later on, when they are accustomed to eat from the boxes, they will eat only as much as is needed.

FEEDING OF YOUNG STOCK

At the age of about three weeks, while still suckling the mother, the young pigs should start eating. The food should consist of a few handfuls of dry grains like crushed oats. At about one month's age, the piglets should get feed prepared by mixing wheat milling offals and barley or maize in skimmed milk. A few days before weaning, the diet of the young pigs should be increased gradually. No abrupt changes in the type and quantity of food should be made.

Piglets should be fed four to five times a day. As the young pigs grow, their feed should have less of liquids.

FEEDING THE BREEDING STOCK

Breeding stock need special attention. Animals which are in poor condition should be provided additional feed about a week before the starting of the breeding season.

A mixture of six parts of maize, three parts ground barley or wheat and one part fish or meat meal has been found suitable for breeding stock. A mixture consisting of five parts maize, 2·5 parts ground barley, 1·5 parts wheat bran and one part fish or meat meal has also given good results.

Fish or meat meal may be substituted with skimmed milk or buttermilk, wherever cheaply available. Kitchen swill can form an important item of food for pigs and may be used as a supplementary diet either alone or in conjunction with cereal by-products. Whenever possible, green vegetables such as turnips, cabbage, beans and potatoes should be provided. Waste from slaughter houses should always be thoroughly cooked before feeding. Roots are best given uncooked, but potatoes should never be given raw.

In the early stages of pregnancy, a sow may require daily about one and a half kilograms of concentrate mixture, provided sufficient green feed is available. In the later stages of pregnancy, the sow should get about two and a half kilograms of concentrate ration per day. Three or four days before farrowing, the feed should be slightly reduced. The quantity of grains should be substituted by bran which has laxative effect. If a sow shows any sign of constipation, linseed meal may be added to the feed.

Special attention is needed in the feeding of breeding boars to get the maximum service. The boar should always be kept in a thrifty condition, neither too fat nor run down in flesh as either of the extremes may affect his breeding power adversely. During the breeding season, the quantity of protein-rich feeds like soyabean meal, fish meal, meat meal and dairy by-products, such as skimmed milk and buttermilk should be increased in the ration.

Boar should have access to a good pasture. If a suitable pasture is not available, some succulent leafy fodder should be provided in the paddocks. In addition to the usual ration, stud boar should get an ample supplement of mineral mixture. Grains should always be crushed and soaked for a few hours before feeding to ensure proper digestion. It is highly desirable to provide some green feed throughout the year. Hay from some suitable legume should also be given.

FEEDING OF FATTENING STOCK

For fattening pigs, more of starchy feeds and less of protein-rich food should be given. A good mixture should consist of 20 parts of maize to one part each of slaughter-house waste and soyabean meal. The use of soyabean should, however, be restricted as it tends to produce soft pork. Soup prepared from the bones from the bacon factories, mixed with the grain mixture, is also considered suitable for feeding the fattening stock.

If the market demands pork with plenty of fat, the stock should be fed on maize. It is comparatively cheap and contains a high percentage of carbohydrates which are easily converted into fat inside the body. If, however, there is a demand for bacon and ham with less of fat, skimmed milk and buttermilk mixed with maize or equal quantity of gram should be fed.

Feeding of fish meal for slaughter stock should be very cautiously done to eliminate the risk of any fish taint in the flesh. Ration should not contain more than fifteen per cent fish meal in the weaning stage, ten per cent in the intermediate stage, and five per cent in the later stages of fattening. Fish meal should be eliminated altogether from the ration for about a fortnight prior to slaughter.

In addition to green feed, the fattening stock should be given approximately a kilogram of concentrate mixture up to 23 kilograms of body-weight. Therefore, for every 23 kilograms increase in body-weight, roughly half a kilogram of additional concentrate mixture should be fed, the full ration being three kilograms per adult pig.

HOUSING THE PIGS

To get the maximum returns, pigs should be properly housed and protected from excessive heat, rain or cold. Provision of comfortable, well-ventilated and sanitary pens is necessary to keep the animals healthy and for their optimum growth. Under Indian climatic conditions, elaborate and expensive houses are not necessary.

Pigs should not be kept in overcrowded and damp houses. The site for housing pigs should be at a higher level than the surroundings, to facilitate proper drainage. The floor and feeding troughs should be such that they can easily be cleaned.

Each pen should preferably have an open yard with some natural shade, where the animals can move about freely. To keep the pens warm during winter, they should be bedded with dry straw. During hot weather, small wallows containing water, about 20 to 25 centimetres deep, should be provided in the paddocks to keep the pigs cool.

The number and size of pens will, of course, depend upon the number of pigs to be accommodated. A pig house generally consists of a central house with a passage 15 centimetres wide, running lengthwise in the middle and a set of pens on either side, each measuring 3·5 metres by 2·5 metres, connected with an open-air yard of the same dimensions with *pucca* floor. Leading from the open yards, there should preferably be a common spacious grazing ground on either side with a few shade-trees.

PREVENTION OF DISEASES

For successful pig-rearing, the maintenance of a good state of health among the animals at all stages of growth is of the greatest importance. Most diseases of pigs can be prevented. Preventive measures are much more effective and less expensive than cures. Among the important points in disease-prevention are good housing, adequate supplies of fresh air and sunshine, provision of clean fresh water, adequate feeds, daily exercise and proper sanitation.

Pigs should always be suspected of being ill when they lie down a lot and are disinclined to move when provoked. The other symptoms of illness are loss of appetite, rapid respiration, constipation or diarrhoea, discolouration of ears, dullness, higher pulse-rate and rise in temperature.

The normal temperature of pigs varies from 38·3 to 40 degrees C (101 to 104 degrees F), the average being 38·9 degrees C (102 degrees F). The normal pulse-rate varies from 55 to 75 per minute and the respiration ranges from 20 to 30 per minute.

In the case of contagious diseases, the suspected animal should be segregated at once to avoid the spread of infection. If possible, separate attendants should look after sick animals. After attending to the sick animals, the attendants should properly disinfect their hands and feet. All excreta and infected litter should be carefully disposed of. The premises should be thoroughly disinfected. The walls should be white-washed with lime containing D.D.T. When white-washing, especially *kutcha* structures, all the crevices should be thoroughly filled up. The carcass of infected animal should be buried deep with a layer of lime or disposed of by burning. The help of a veterinarian should be sought promptly, as losses can often be prevented and the spread of disease minimised if early skilled attention is obtained. Healthy animals, which have been in contact with infected ones, should be got protected with proper vaccination or serum.

COMMON DISEASES OF PIGS

Symptoms of some of the common contagious diseases of pigs and the specific precautionary measures which will help in preventing their spread are briefly described.

Swine Fever is a highly contagious disease. It is accompanied by high fever and appearance of red or purplish blotches on the skin of the ears, belly and inner side of legs. The other symptoms are loss of appetite, laboured breathing, cough, weakness, vomitting and diarrhoea.

Preventive measures include immediate segregation of affected animals. The premises should be thoroughly disinfected and strict hygienic measures should be adopted. The healthy pigs should be vaccinated.

Foot and Mouth is a contagious disease. The chief symptoms of this disease are high temperature, appearance of vesicles, followed by ulcerations on the mucous membranes of the mouth, foot lesions and difficulty in walking and mastication of food.

The infected animals should be isolated. The premises should be thoroughly disinfected and cleaned. Antiseptic lotions should be applied to the feet and used as mouth-wash.

Swine Pox is a highly contagious disease and is characterised by fever, loss of appetite, and eruptions over the skin, occurring most commonly on the ears, neck, inner surface of the thighs and under-surface of the body. In severe cases, lesions may occur on all parts of the skin.

The affected animals should be separated and kept in clean and comfortable quarters. They should be given light diet. The lesions should be properly treated. Slaughter of all affected animals and the in-contacts is recommended.

Swine Plague is an infectious disease of pigs. It commonly occurs as a complication to swine fever. It is characterised by high fever, loss of appetite, staggering gait, laboured respiration and sometimes swelling of the throat and diarrhoea or dysentery. Haemorrhage may occur from nose, anus and urinary organs.

The affected animals should be isolated and the premises should be thoroughly disinfected. The in-contact animals should be inoculated. The carcass and infected litter should be disposed of by burning or deep burial with lime. Healthy .pigs should be vaccinated as a prophylactic measure.

Swine Erysipelas is a contagious disease of swine. The disease is characterised by high fever, skin-lesions in the form of slightly raised diamond-shaped markings, distinct redness of the ears, the skin behind the ears, thighs and belly. In the early stages, there is constipation which is later on followed by diarrhoea.

The affected animals should be segregated and premises thoroughly disinfected. All in-contact animals should be given a protective dose of anti-serum, which confers immunity for about a fortnight. Vaccination for longer and active immunity against this disease may be carried out during April-May as a preventive measure. The defects in diet, housing and management should be removed. Strict hygienic conditions should be maintained.

Anthrax is a highly contagious and fatal disease of pigs. It is characterised by high fever followed by swelling of the throat, blood coloured urine and respiratory distress.

The carcass and infected litter should be properly disposed of. The carcass should not be allowed to be opened as the disease is communicable to human beings. In areas where the disease is endemic, animals should be vaccinated as a preventive measure. In the event of an outbreak, anti-anthrax serum should be used.

Tuberculosis is a chronic contagious disease characterised by fever and nodular lesions which may occur almost on any part of the body. The pigs may get infection from infected poultry or cattle.

When the disease is suspected, the entire herd should be tested. The positive reactors should be slaughtered. The carcass and infected litter should be properly disposed of. Strict hygienic measures should be observed.

Infectious Dysentery is a common disease of pigs. The main symptoms of this disease are slight fever and general passivity followed by a dark coloured bloody diarrhoea. The animal remains mostly lying down and shows signs of quick emaciation.

The affected pigs should be segregated. Infected litter and excreta should be properly disposed of. Grain feed and tankage should be withheld and light diet should be given.

Piglet Influenza is an infectious disease which generally occurs in young pigs. The main symptoms are rise in temperature, discharge from the nose and eyes, cough, pneumonia, pleurisy and inflammation of joints, especially of hind limbs.

To prevent this disease, all healthy animals should be segregated. The pigs should be kept in dry and clean pens with plenty of bedding. They should be kept warm.

V

HORSES, DONKEYS, AND MULES

INTRODUCTION

HORSE is perhaps one of the earliest animals domesticated by man. As a class, horses, mules and donkeys are first cousins. They are all single-toed mammals and their toes are enclosed in hoofs. The present-day horse is believed to have descended from an animal not bigger than a fox. It has passed through at least twelve distinct stages during a period of over three million years. At present, there are no less than 60 different domesticated breeds of horses in the world.

Horse is proverbially known for its robust common sense. Since time immemorial, horses have served man both for work and for sport. In times past, horses have been widely used in warfare.

Horse is a useful animal, specially suitable for quick and easy transport. In the hills and submountain areas, the horse serves as the only means of transport, and a good number of people in the villages depend on it for their daily routine. It provides a cheaper form of transport for carrying short distances. Horses are said to earn their living by being on the move.

In spite of the setback this important livestock industry has received due to the increased use of mechanised means for road transport, India still possesses some valuable stock of the indigenous breeds which is capable of further development and propagation. Most of the Indian breeds are well adapted for the specialised type of work they are required to perform.

According to the 1977 census, there are in India, 0.89 million horses and ponies as compared to 0.94 in 1972 and 1.51 in 1966. Statewise, they are 0.29 in Andhra Pradesh, 0.18 in Assam, 1.10 in Bihar, 0.76 in Gujarat, 0.27 in Haryana, 0.15 in Himachal Pradesh, 0.69 in Jammu & Kashmir, 0.27 in Karnataka, 1.18 in Madhya Pradesh, 0.49 in Maharashtra, 0.40 in Orissa, 0.76 in Punjab, 0.49

in Rajasthan, 0.11 in Tamil Nadu, 2.04 in Uttar Pradesh and 0.15 million in West Bengal.

IMPORTANT BREEDS OF HORSES

The most important breeds of Indian horses are Kathiawari, Marwari, Bhutia, Manipuri and Spiti.

Kathiawari breed of horses is said to have originated from the imported Arab stallions, a ship-load of which once got wrecked on the West coast of India. These animals are extensively bred in Kathiawar in Gujarat State.

The head of the Kathiawari is like that of the Arab horse. The tips of the ears tend to meet towards the centre of the pole. Generally, these animals have sickle hocks. The prevailing colours are chestnut, brown and grey.

Kathiawari horses look elegant, shapely and majestic. They are hardy animals, with good bone and easy action. They are well known for their pace and speed.

Marwari horse is closely associated with great feats of bravery attributed to the Rathore chiefs of Rajputana. The home of this breed is Marwar in Rajasthan State.

The main characteristics of the Marwari breed are similar to that of Kathiawari. It is believed that both of them have a common ancestry and the minor variations are due to difference in environmental and climatic conditions under which they are reared. The most favoured colours are chestnut and bay.

Marwari horses are majestic, noble and handsome. They are noted for ease of pace, speed and endurance.

Bhutia animals are bred in parts of Nepal along the Tibetan border and sub-Himalayan tracts from the Punjab to Darjeeling in West Bengal.

The chief characteristics of this breed are compact body, short thick neck, strong back, good bone, round muscular quarters, coarse hairy legs and long tail and mane. The feet are fairly open at the heels. The common colours are grey and iron grey, though occasionally chestnut and roan are also found.

These animals are very popular in the hilly areas for riding as well as for pack purposes.

Manipuri ponies have been bred for many centuries in Manipur State.

Though small in size, these animals possess a proportionate body. The head is small and carried well-up on a strong muscular neck. The face is long, muzzle fairly broad with well-dilated nostrils. The chest is broad and the ribs well-sprung. Legs are of fine quality, knees and hocks strong, the pastern has a gradual and proportionate slope.

Manipuri breed is noted for its elegance, and speed. These animals are sturdy and sure-footed. They are in great demand for polo, racing and for military transport.

Spiti breed of ponies inhabit the Spiti tract which lies in the Kulu sub-division of Kangra district in the Punjab.

It is a small animal with compact body, fine head, sharp ears, good bone, round feet, and legs covered with coarse and long hair. The ribs are well-sprung and the quarters are well-developed. The prevailing colours are dark grey, iron-grey and dun.

Spiti pony is a hardy and sure-footed animal, particularly suited to hilly conditions. It is well known for its stamina to withstand long journeys, inclement weather and its capacity to subsist on meagre ration. These animals are mostly used for pack purposes and for riding.

Besides the above breeds, a few animals of the Pakistani breeds of horses such as *Baluchi*, *Hirzai* and *Unmol* are also found in India.

A great many of the horses used in India for riding, racing and polo possess, to varying degrees, Arab and Thoroughbred strains in them. The Arab and Thoroughbred are well-known breeds of horses all over the world. The Arab is considered the most ancient breed of horses which forms the basis of nearly all present-day light horse breeds. Arab is considered an ideal breed for riding purposes and for carrying weight. The Thoroughbred is unsurpassed as a race horse and is known for its speed, spirit and enduring power.

More recently a few animals of Connemara breed have been imported in Himachal Pradesh and are being used for improving the hill ponies.

Breeding of Horses

Horses, as compared to other domestic animals, have a lower reproductive rate. They are more difficult to breed and have longer gestation period.

The average age of puberty in a filly is 15 to 18 months, but she should not be bred till she has reached the age of three years or more. Raçe mares and show mares are generally bred after their careers have ended. Stallions attain maturity at the age of 4½ to 5 years. They can, however, be sparingly used for breeding when three years old.

In India, early spring is considered the best breeding season for horses. There is less mortality in spring foals as compared to winter foals due to warm weather.

As a rule, 30 to 40 mares are allowed to a stallion, depending upon its age and number of services allowed per mare. Generally, under the best conditions of management, two or three stallion services per mare are required. Under average conditions, only about 50 per cent of the bred mares conceive and produce living foals. For a breeding farm, 70 per cent is considered a good average.

Most horsemen prefer to use a stallion for breeding service only five times in a week, but more frequent use is often necessary during the peak of the breeding season. Over-exertion, however, affects adversely its capacity for service and fertility. The stallion, during breeding season, must not be allowed to lose condition.

After foaling, mare comes into heat in four to eleven days which is called foal-heat. Although breeding on the ninth day after foaling is a common practice, such matings should be made only if the mare has completely recovered and had a normal foaling.

The oestral cycle in mares averages 21 days. The duration of heat varies from seven to nine days. The optimum time to breed a mare is late in the heat-period, usually on the seventh day of heat. As a rule, the mare drops one foal at each birth. Twins are seldom born.

The indications of heat in the mare are restlessness, relaxation of the external genital organs, frequent urination, mucous discharges from the vulva and display of keen sexual desire.

Strict hygienic measures should be observed at the time of mating. After mating is over, the mare should be led around for a short time, to prevent straining. The genital organs of the stallion should be washed properly after each service.

A mare carries her young for 340 days. After the mares have been served, they continue to work as usual till they are almost half way through their pregnancy period. For the last four or five months of pregnancy, however, the mare should not be allowed to work for long hours.

The udder of the pregnant mare enlarges during the eleventh month. A week or ten days before the foal is expected, the mare should be put in a roomy box. A day or two before foaling, beads of wax are generally formed on the teats and sometimes milk may run from the udder. Other signs of approaching parturition are a depression of the croup muscles on either side of the tail and relaxation of the lips of the vulva. Just before foaling, the mare is restless, paws the bedding, sweats a little and frequently lies down and gets up. Mares usually foal when lying down.

At foaling, mare should not be unnecessarily disturbed. A normal foaling does not take much time. The foal's navel cord should be treated with iodine as a precaution against infection. The after birth usually comes out in an hour or two. After it falls, the hind quarters and tail of the mare should be washed. The soiled matter should be removed and fresh bedding provided. After delivery, the mare should be given a drink of lukewarm water and bran mash.

A normal foal will be on its legs in ten minutes to an hour after birth. The foal should not be hurried in its efforts to rise. The foal should begin to suck milk from its mother immediately as it is able to rise. The colostrum or first milk from the mare is laxative and healthy for the new-born. At birth, a foal usually weighs from six to ten per cent of the weight of the mother.

A mare's milk contains 9·42 per cent solids. Its fat and protein contents are very low as compared to the milk from cow or goat. The milk of mare, on an average, contains 2·05 per cent protein, 1·14 per cent fat, 5·87 per cent sugar, 0·36 per cent minerals, and 90·58 per cent water.

FEEDING THE HORSES

The horse is a herbivorous animal, but does not ruminate like cow or camel. Unlike ruminants, that have four large compartments of the stomach, the horse has just one stomach like that of a man. The stomach of the horse is comparatively small and has a capacity of only ten to eighteen litres. The horse, therefore, needs to be fed oftener but in smaller quantities. A horse cannot endure prolonged abstinence from food. On the other hand, many good horses have been ruined due to overfeeding. When extra ration is to be given to improve the condition of the horse, it is desirable to increase the number of feeds rather than the quantity fed at each meal.

In feeding horses, regularity is very important. It is a general practice to feed hay before grain is given to the horse. Chopped hay, however, can be given along with the grain. A horse should not be put to hard work after full feed, nor a full feed should be given to an exhausted horse. This is a very common cause of digestive troubles in horses. Changes in ration should be made gradually, as a sudden change may cause colic, which may prove fatal in horses. It is best to give water before feeding. The horse should never be fed stale, mouldy or inferior stuffs.

Horses almost always are fed individually. Each horse should be fed according to the type of work he is required to do. Stallions, during breeding season, brood mares, and nursing foals should be fed liberally. The ration for pregnant mares must be well-balanced, high in protein, mineral and vitamin content. It should, however, be not conducive to fatty condition in the mare. To promote growth, foals and yearlings should be well-fed.

COMMON FEEDSTUFFS FOR HORSES

Oats are the most suitable and safest of all grains for feeding horses. Oats have sufficient protein content to make a balanced ration when fed along with grass hays. Generally, they are fed whole, but sometimes crushed oats are also given. Barley and gram are commonly used as horse-feeds. Barley makes a satisfactory substitute for oats. Barley and gram should always be given crushed. Wheat bran is palatable and laxative, and may be substituted for a large part of the oats in the ration. Bran is rich in phosphorus but deficient in calcium. This deficiency can be made up by providing food hay. Bran is generally fed dry but may be fed as a mash prepared with hot water. Linseed meal is a protein-rich feed for horses. It specially helps in putting a bloom and sheen on a horse's coat. Where available, molasses may be substituted for a part of the grain. Molasses are generally given after being diluted with water and mixed with grain-feed.

The most natural feed for horses is pasture grass. Good pasture is essential for their healthy and quick growth. Grasses are not only the best protective feed, but also help in reducing the feed and ration costs. Green grass is especially important for brood mares and foals. The horse, however, prefers selected grazing and should not be left on a swampy or water-logged lands.

Lucerne and other legume hays are commonly used for feeding horses. *Dhub* grass is very popular. Carrots are also relished by horses. Hay or grass used for feeding should be clean and free from dust.

Salt and minerals are essential to keep horses healthy, especially for pregnant and nursing mares. Horses should be given daily 28 to 56 grams of mineral mixture consisting of equal parts of finely-ground limestone, steamed bonemeal and salt. Iodized salt should be added in iodine deficient areas.

Generally, a daily ration of 2·5 to 3·5 kilograms of grain mixture and about 6·5 kilograms of hay are given to an adult working horse. The grain ration should be given in two or more feeds, depending upon the quantity of grain that the horse is able to consume within thirty minutes. For tonga ponies, the daily ration usually consists of 2 kilograms bruised gram, 0.7 kilogram each of crushed barley and wheat bran, 4·5 kilograms hay and 28 to 56 grams of common salt or mineral mixture.

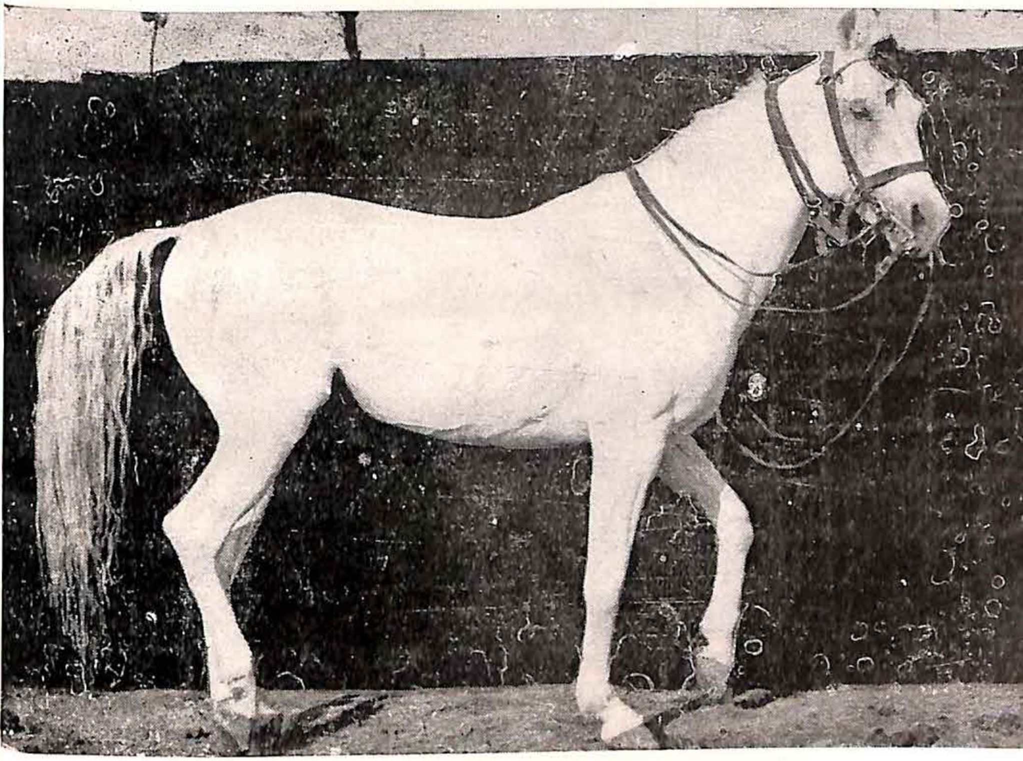

Fig. 11. Kathiawari Horses are Elegant and Majestic
(*See page* 75)

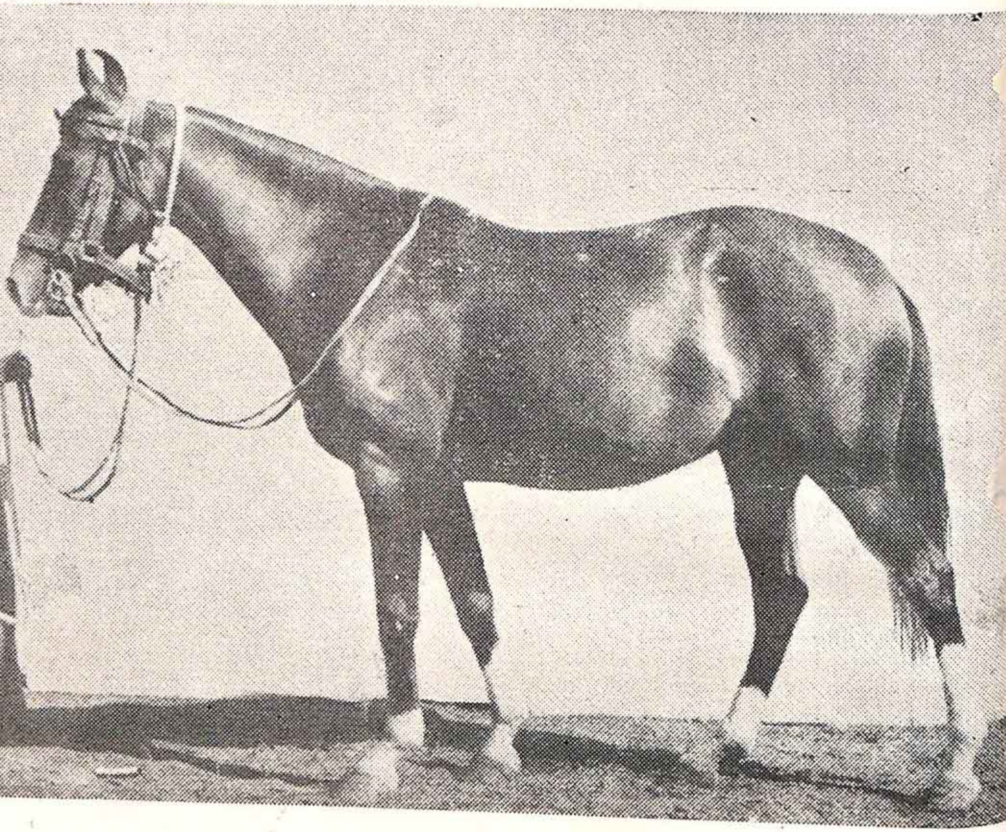

Fig. 12. Marwari Horses are Noted for Speed and Endurance
(*See page 75*)

When green grass is available, half a kilogram of hay may be substituted by 1·5 kilograms of green grass.

WATERING

Horses should be supplied with plenty of fresh water at regular hours. They should not be supplied with water immediately before and after being put to work. A horse, on an average, drinks 45 to 55 litres of water in a day.

GENERAL MANAGEMENT

Horse needs skilful handling. Few horses are inherently vicious. Many are made so by improper handling. Horse should be handled firmly but gently. He should always be spoken in kindly tones and never maltreated. Horse feels greatly encouraged when affectionately patted.

TRAINING OF HORSES

Horses can be broken and trained at almost any age, but it is best to do so while the horse is young. The younger it is, the easier it is to handle. Foal should be handled frequently from early age. The colts should be taught to lead when they are one to two months old. At first he can be led alongside his mother when she is taken out for exercise or water. Saddle horses may be broken to ride and drive when two years old, but they should not be put to hard work until they are at least three years of age. A horse should be brought to full work gradually.

Great patience and care are required to train a colt. Training should be on a system of reward or punishment, and it should immediately follow the action which deserves it. Horses learn to obey largely by association of actions with commands. The same word or signal, therefore, should always be used for the particular response desired.

WEANING OF FOALS

Foals are generally weaned when five to six months old. Early weaning may interfere with their proper growth. After weaning, it is necessary to keep the foal completely separate from the dam. Colts and fillies may be kept together or allowed to run together until they are yearlings.

EXERCISE

Vigorous exercise helps to maintain hard physical condition and health of a horse. Horse should be given regular exercise daily. Plenty of exercise is especially important for brood mares, stallions and colts. The stallion should be given sufficient exercise, especially during the breeding season by driving it or riding for eight to ten kilometres every day.

When starting the day's work, the horses should be gradually warmed to their task, before being put to extreme exertion.

GROOMING

Horses need regular and vigorous grooming to keep them healthy. Proper grooming keeps the horse clean and helps in imparting a glossy and shining coat to the skin. Massaging stimulates blood circulation and improves the condition and general appearance of the animal. It also provides a sort of passive exercise.

An idle horse requires more thorough grooming than a horse at work. Horses should be lightly groomed before going to the work but they should be given vigorous grooming on their return. The animal, however, must be cool and dry when groomed. Brush should be used on tender parts of head and legs.

SHOEING OF HORSE

A good horse must have sound hoof. 'No foot, no horse', is an old saying. Hoof-care starts when the foal is about one month old. Generally, horses are not shod until the age of two to three years. Hoof grows about 8 millimetres every month. A young horse requires re-shodding every six weeks.

HOUSING OF HORSES

Horse should be housed in hygienic and comfortable stables.

The stables should be so constructed as to provide sufficient protection from inclement weather, excessive heat, cold, and rain. Cool quarters with good ventilation are preferable to warm, close stables.

The site for the stable should be slightly at a higher level than the surrounding area. There should be adequate facilities for water supply and drainage. Construction of the stables need not be unnecessarily costly. The stable should, however, be roomy enough to provide sufficient space for the horse to stand and lie down comfortably.

The floor should be level and non-absorbent. It should have rough surface to avoid slipping. Horse should not be allowed to stand on wet floor. It makes the hoof soft and liable to many foot troubles.

The stables should always be kept clean and dry. The horse should be provided with suitable straw bedding. Wet and dirty beddings cause skin diseases.

In the cold weather, the horse should be covered with a blanket after the work is over.

DETERMINING THE AGE OF A HORSE

The age of a horse is generally determined from its teeth. Horses have three pairs of incisor teeth in each of the upper and lower jaws. The first pair of incisor milk teeth appear before the foal is two weeks old. The second pair comes at four to eight weeks of age and the third corner pair appear in six to nine months. A yearling will have all the six incisor milk teeth in both the upper and lower jaws.

The permanent central incisors start erupting after about two and a half years. The three-year-old horse has one pair of permanent incisors in each jaw. A four-year-old has two pairs and a five-year-old has three pairs of permanent incisors. At this age the horse is said to have a full mouth.

As a horse gets older, its teeth start wearing. The age of a horse from 5 to 12 years can be approximately judged from the presence or absence of cups in the wearing surface of the teeth.

By the time a horse reaches an age of 10 to 12 years, the cups in all the incisor teeth disappear. The horse at this stage is said to be smooth mouthed.

Horses may live up to the age of 40 years, but the average working life of a horse is twelve to fifteen years.

DONKEYS

Donkey is the most simple and unselfish member of the equine family. It is a very hardy animal and can work incessantly, almost without rest on poor forage. It is mainly used as a pack animal and is particularly known for its sure-footedness. The Nubian ass is believed to be the parent of the present-day donkey. It was perhaps domesticated around 4,000 B.C. in Mesopotamia and Egypt.

Donkeys do well in hot and semi-arid areas. They are commonly known for their stupidity and obstinacy. These qualities are, however, the result of ill-treatment by man from time immemorial. With sympathetic and proper handling, these vices can be minimised.

In India, there are 1.01 million donkeys in 1977. This was an increase of 0.2 per cent in their number over that of 1972. According to Livestock Census of 1972, there were 6.99 donkeys. This showed a decrease of 0.94 per cent over that of 1966. Rajasthan has the largest population of donkeys. Uttar Pradesh comes next followed by Gujarat, Tamil Nadu and Haryana.

There are two types of donkeys, small grey and large white, which are commonly met with in India. The small grey donkey is found in most parts of the country. Its colour is dark-grey with zebra stripings on the limbs, neck and quarters. The large white type is mostly found in the Kathiawar region of Gujarat State. It is generally light-grey to almost white in colour.

Some of the important foreign breeds of donkeys are the White Egyptian, the Damascus, the Persian, the Arab, and the Poitou donkey of France. The Poitou donkey is perhaps the largest and the Indian ass the smallest in the world.

Donkeys are generally bred at the age of 2½ to 3 years. There is no particular season for breeding donkeys. They can be bred throughout the year. Matured male can be allowed 160 coverings in a year but not more than two services a day. The gestation period in females varies from 11½ to 12 months. The usual length of time between heat periods is 21 to 28 days. The heat-period lasts three to seven days. The optimum time to serve the animal is on the third day of heat. The animal can be bred after parturition after six to eight weeks.

The lactation period ranges from 6 to 12 months. The young one is generally weaned at the age of six months. Usually one young is born at a time.

The milk of an ass contains 1·37 per cent fat, 1·85 per cent protein, 6·19 per cent sugar, 0·47 per cent minerals, and 90·12 per cent water. The milk of an ass is easy to digest. In India and some of the other countries like Italy, Spain and Southern France, the milk of an ass is considered the most suitable substitute for human milk.

Donkeys usually move at a pace of three to five kilometres per hour and can cover about 25 to 32 kilometres in a day. As a pack animal, males are preferred over females. Donkeys need to be shod like horses. The usual working age for donkeys is 16 to 17 years.

MULES

Of all the equines, mule is perhaps the most intriguing animal. It is produced as a result of crossing between a male donkey and a mare. The opposite cross, between a she-ass and a stallion pony is not very common. Both male and female mules are infertile. Mule is known for its great capacity for endurance under adverse conditions of climate and food. It is the most favourite of all pack-animals, particularly in the rugged hilly tracts. Mules can endure more neglect than horses. Because of their peculiar shape of the foot and the thick, strong wall and sole, mules are less subjected to foot lameness.

The mule is said to be its own boss. It is supposed to have inherited its intelligence from the horse and sound footedness from the donkey. Mules are, however, shy with strangers and are often free kickers.

Due to the recent opening of the Northern hilly frontiers of India all along the Himalayas, the importance of the mule has greatly increased for use in military operations. The present number of mules in India is, however, very small. Although there has been an increase in mule population of 30·8 per cent in 1961 over that of 1956, and 41·6 per cent increase in 1966 over that of 1961, yet there are only 74,775 mules in the whole country. In 1972, Uttar Pradesh had the largest mule population 37,000 followed by Haryana 0.09, Himachal Pradesh 0.7, Punjab 9,000, Madhya Pradesh 0.02 and Bihar 0.01.

To keep mules in good working condition, they need constant care and attention. The same general rules of feeding and stable management are applicable to them as to the horses. They, however, can thrive on poor fodder and are less susceptible to diseases.

The daily ration for pack artillery mules in the army consists of a little over one kilogram each of crushed gram and crushed barley, nine kilograms of bhusa or lucerne hay and 28 grams of common salt. In the case of light draught mules, an additional ration of one kilogram of bran is given.

Although mules can endure thirst well, yet they should be provided sufficient fresh water every day. They prefer to drink water from a bucket than from a running stream. Mules are good swimmers and can cross deep streams easily.

Mules should be regularly groomed. When unsaddled, they should be allowed to roll freely on the ground. Mules working on hard ground need to be shod the same way as horses.

Mule is generally considered fit to work when three to four years old. The normal pace of a mule is about five kilometres an hour and it can easily cover 24 to 32 kilometres in a day. Mules can work till the age of 18 to 20 years or even longer.

EQUINE HEALTH

Equines, especially horses, are susceptible to a number of diseases and ailments. They need, therefore, special attention and care to keep them healthy. A healthy animal is active and alert. Its eyes are bright and ears frequently pricking to and fro. The hair coat is smooth and glossy. The animal shows normal appetite. It drinks and sleeps well. A healthy horse normally bears its weight equally on both front feet. A horse never rests on its forelegs unless there is something wrong with it. When the horse is at ease, the hind feet usually are not kept squarely together on the ground, but are rested alternately.

Preliminary indications of disease are dullness, loss of appetite, profuse sweating, pendulous ears, high temperature, fast breathing, fast pulse rate, discharges from eyes and nostrils, diarrhoea or constipation, lameness or swelling in any part of the body.

The normal body temperature of a horse at rest is about 37·8 degree C (100 degree F). The temperature increases when the animal is excited or at work. The temperature in a horse, can be taken with an ordinary clinical thermometer inserted in the rectum for three minutes.

The normal pulse rate of the horse at rest varies from 36 to 40 per minute. It is higher in very young animals. After strenuous work, the pulse rate may go to 80 or 90, but returns to near normal within an hour. The pulse count can be taken by placing the finger tips over the artery that rounds the jawbone in front of the large cheek muscle.

Normally, the respiration rate of a horse ranges from 8 to 16 per minute, but it may increase to 70 or more after a short exertion. In a healthy horse, breathing will subside to normal more quickly than his pulse rate after exercise is stopped. The breathing rate may be observed by watching the movements of the flank or the nostrils.

In a healthy horse, the bowls are moved frequently, about eight to ten times in 24 hours. The droppings are usually in the form of balls that are soft enough to split as they fall on the ground. The urine is passed several times daily and is light yellow in colour.

In donkeys, the normal body temperature is 37·5 to 38 degree

C (99·5 to 100·4 degree F). Respiration is about fifteen per minute. The pulse-rate is 38 per minute.

In mules, the normal temperature, rates of respiration and pulse are similar to that of a donkey.

COMMON DISEASES OF EQUINES

Influenza or Pink Eye is a common disease in equines. The chief symptoms of the disease are rise in temperature which continues for three or four days, eyes become bright pink in colour, eyelids may be swollen and show watery condition, a harsh cough and serious nasal discharge.

Preventive measures include isolation of all suspected cases, chlorination of drinking water and adoption of strict hygienic measures. All newly-purchased animals should be kept in a separate stable for two to three weeks.

Strangles is a highly infectious disease. The main symptoms are dullness, depression and rise in temperature. Initially there is a slight watery nasal discharge, which soon becomes thick and yellowish white, abundant and bilateral. Throat is sore with occasional cough. Lumpy abscess appears in the throat region. The lump gradually increases in size. The animal feels difficulty in swallowing food and shows signs of laboured respiration.

The affected animal should be segregated. The stable, manger and watering utensils should be thoroughly disinfected. Easily digestible ad nutritious feed should be given. The recovered animals should not be returned to work immediately.

Glanders-Farcy is a highly infectious and fatal disease. It is characterised by ulcers on the nasal mucous membranes, which become dull, dirty and slightly bluish. Superficial lymph vessels are swollen, and small elevations arise along their course. Buds burst, giving out thick creamy pus, which later on thickens on the edges off the buds.

To prevent the spread of this disease, all affected animals should be destroyed. The carcasses should be disposed of by burial or by burning. All suspected animals, should be immediately isolated from healthy ones. Healthy animals should not be allowed to use water and feeding troughs used by affected animals.

Epizoatic Lymphangitis is also a highly infectious disease in which the lymph vessels swell, burst and ulcerate, discharging thick, creamy pus. The whole limb may become considerably swollen. Mucous membranes become anaemic.

All suspected animals should be segregated. The affected animals should be destroyed. All utensils in contact with the diseased animals should be thoroughly disinfected.

Tetanus is characterised by patchy sweating and bowels becoming constipated. Mastication ceases and swallowing becomes difficult. Nose is outstretched. The nostrils are dilated. Lips are drawn, exposing the teeth. Stiffness appears in different parts of the body. Tail is kept raised and quivering. The animal walks with stiffness, dragging the straw about with its feet.

The affected animal should be kept in a dark and quiet place. The animal should not be given drench when it is in a state of excitement. All wounds should be treated with an antiseptic.

Colic is a fairly common ailment in equines. The animal feels restless, and has anxious appearance. Cold patchy swellings develop all over the body. The animal lies down, rolls, gets up again, looks frequently towards flanks and kicks forward at the abdomen. Respiration is blowing and accelerated. Faeces may be passed in small quantities.

Preventive measures include feeding animals oftener and in smaller quantities. Food should be given at regular hours. Inferior or damaged food and sudden change in diet should be avoided. Horse should not be given full feed just before putting it to fast work and cold water soon after hard work.

South African Horse Sickness is a highly fatal and infectious disease. Horses are most susceptible, mules less and donkeys the least. Incidence of the disease is very high during the warmer rainy months. In winter, the disease generally subsides totally. Respiratory tract, or heart, or both may be involved. Symptoms vary with the organs involved and the severity of the disease.

In the case of pulmonary form, the respiratory tract is affected. There is rise in temperature, difficulty in breathing and frothy discharge from the nostrils. Death takes place within 36 hours. This is the most virulent of all the types. Mortality may go up to 100 per cent.

In the case of cardiac form, the heart is involved. There is a slight rise in temperature. Heart action becomes feeble. Swellings appear over the forehead and may extend up to brisket and the fore limbs. Sometimes, the swellings are so great that the eyeballs may be pushed out. Animals continue to nibble till death. Temperature however falls below normal before death. Animal may die in three to four days. Mortality rate in this form of disease is nearly 95 per cent. On post-mortem, the pericardium is found distended, with plenty of clear straw-coloured fluid.

In the case of mixed form of the disease, both heart and lungs are affected. This form is most common in India.

Prevention consists in protecting the animal against the attack of culicoides which transmit the disease, and giving preventive inoculations. Absolute cleanliness of the stable and surroundings should be maintained. The animal should be regularly groomed. In the rainy season, animals should be removed to high lands and away from pools and ponds. In the evenings, the animals should not be permitted to stay away in the pasture, but should be kept in the stalls. The animals should be given nutritious feed to maintain their vitality.

VI

CAMELS

INTRODUCTION

CAMEL has been aptly described as the ship of the desert. It is indeed the most valuable beast of burden and transport in hot, arid and sandy regions. Due to its extraordinary power to resist thirst and hunger, camel is commonly believed to be a mystery animal. It can maintain itself on thorny shrubs in a desert, where other herbivores will die of hunger. Camel is a ruminant like cattle, sheep and goats.

Nature has endowed the camel with many special features to make it fit for life in a desert. Its hump acts as an emergency food-store in the form of fatty tissues to enable it to live under drought conditions, without much to eat. Owing to the greater thickness of the skin, the water loss through evaporation is reduced to a minimum. Due to this and a number of other factors, the camel can go without water for a much longer period than any other mammal. The fine hair on the body of the camel act as insulation and help to ward off the excessive atmospheric heat. The lips of the camel are covered with tough skin, which enables it to eat hard and thorny plants. Due to its long neck, the camel can have easy access to the branches of the high trees. Its thick foot-pads help it to walk on loose hot sand without much difficulty. The long eye lashes and long hair in the ears protect it from blowing desert sand. Camel can close his nostrils during sandstorms.

Camel possesses extraordinary patience even under conditions of neglect and rough handling. But at times, under extreme conditions, it may show obstinacy and revengeful character.

The camel, in India, is extensively used for all sorts of work, such as riding, carrying loads, ploughing land, thrashing grains, driving carts and supplying motive power to Persian water-wheels or to sugar-cane and oilseed crushing mills. Camel is often used singly, occasionally in pairs and it is not an unusual sight to see a camel with either a bullock or a buffalo or sometimes even a donkey, yoked to the same plough. In Baluchistan, sometimes a woman and a camel may be seen dragging a plough together. Camel has earned a special reputation for military transport work. Camel is said to do everything for its master except cook his food.

The camel hair is considered a very good material for blankets and other warm garments. The long hair from the tail is woven into cords and ropes which are noted for their strength and durability. Camel hide is used for saddlery. Its flesh is eaten in many countries. Its milk is considered rich and nourishing drink and is used for human consumption.

According to the livestock census 1977, there are 1.07 million camels in India. These were 3.6 per cent less than the number in 1972. In 1972, there were 1.11 million camels which showed a further increase of 0.09 per cent over that of 1966. In 1977, there were 1.07 million camels in India. Statewise there were 0.752 million in Rajasthan, 0.130 million in Haryana, 0.56 million in Gujarat, 0.1 in Himachal Pradesh, 0.3 in Jammu & Kashmir, 0.1 in Karnataka, 0.12 million in Madhya Pradesh, 0.1 in Maharashtra, 0.74 in Punjab and 0.38 million in Uttar Pradesh.

TYPES OF CAMEL

There are two species of camels. The *Bactrian* camel is an inhabitant of Central Asia and has two humps. The second is *Arabian* or *Dromedary* camel which has one hump. In India, only the one-humped species of Arabian camel is met with. The Arabian camel, as a rule, is less heavily built and longer in the hind than the Bactrian. Its coat is soft and comparatively thin.

INDIAN BREEDS OF CAMELS

The camels in India are described as Plain camels and Hill camels, according to the region in which they are bred. The Plain camels include Riverine and the Desert varieties. In comparison with the Plain camel, the Hill camel is more compact animal with shorter legs, rounder feet and greater muscular development.

The Hill camel and the Riverine camels are the baggage type, whereas the Desert camel is a riding type of animal.

The good points of a baggage camel include well-developed hump, thick neck, big head, broad chest, strong legs, and sound foot-pads. A good riding camel is a lighter animal, more active, and high on legs with slender limbs. The head is small. The neck is thin. It has small eyes, short ears, thin skin and small feet.

The Desert camel inhabits the arid sandy tracts of Bikaner and Jaisalmer in Rajasthan.

The Desert camel, like the Thoroughbred among horses, is the most important type. It shows much more breeding than the Riverine camel and is known for its stamina. A good specimen of Desert camel can cover long distances, say, 48 kilometres a day comfortably for days on end. The average speed is nine to ten kilometres an hour.

The Desert camel is light in weight. Its head is small, fine muzzle, thin neck, small ears and close together. The nose is slightly upturned and the forehead has a very conspicuous hollow above the eyes. The chest is broad and the muscles are well-developed. Feet are comparatively small. The tail is long and fine. The carriage of these animals is alert and dignified.

The Riverine camel is mostly found in the Western parts of Uttar Pradesh and the Punjab.

The Riverine camels are great baggagers. They are big in stature, but slow in movement. They can easily carry three to four quintals of weight. The average pace of these camels is usually four kilometres per hour. They can march 19 to 22 kilometres at a stretch.

The Riverine camel possesses coarse head with Roman nose. It has long neck, long legs and oval feet which are generally soft. The hind-quarters are comparatively poorly developed.

The Hill camel is found mostly in the stony hill country of the North Punjab and is an excellent baggage carrier. It is shorter in stature, sure-footed, and is ideally suited for the hilly tracts.

The Hill camel is a compact and muscular animal. The neck is short, the chest is wide and the hind quarters are well-developed. The legs are short and the feet are round and hard.

A large majority of the camels found in the Punjab, Uttar Pradesh and neighbouring areas are from Bikaner and Jaisalmer districts of Rajasthan and Kathiawar and Ahmedabad districts of Gujarat State. Each camel-raising area has its own particular breed named after it, such as Bagri, Alwar, Kachee, Jaisalmer and Bikaneri.

BREEDING OF CAMELS

The camel has a well-defined season of breeding. The sexual instincts of the male are suppressed for most part of the year. It comes into rut, commonly known as *musth*, only during winter months, November to February or March. The actual duration of the rut depends largely on the condition of the animal.

When a number of male camels are kept together, only one or two of the strongest become markedly *musth*. The others, out of fear of their stronger companion, do not show any outward sign. However, when another animal in the herd is unable to suppress its *musth*, a fight ensues between him and the leader of the herd, generally resulting in the beaten animal subsequently suppressing his *musth*.

During the *musth* condition, the camel constantly grinds the teeth, foams at the mouth, swallows air and involuntarily belches it out. During the return process, the flap of the mucous membrane attached to the soft palate gets ballooned out on one side of the mouth like a pink bladder and is withdrawn back after a few seconds. The secretion from the poll-glands is increased and a dark reddish fluid with a disagreeable smell is often seen flowing down the neck. The camel generally stands with hindlegs apart, flapping the tail up and down and may even emit semen.

As the rutting season advances, *musth* camels are liable to fall off in condition due to a partial loss of appetite and the windsucking and belching from which the camel gets little rest. Palliative treatment in extreme cases may be given in the form of overloading and hard work. *Musth* camels frequently become unmanageable and should be handled very cautiously. The males should be kept separate from the females during the rutting season.

The male camel generally shows signs of sexuality as early as two years, but is usually allowed to serve only at the age of six years. The bull-camel attains full sexual maturity at eight years of age when it is considered at its prime.

A bull-camel usually serves 30 to 50 females in a season, but may be able to go up to 70 under good conditions of management and feeding.

A cow-camel is sexually mature at four years of age. It continues to breed up to the age of 20 years. The cow-camel breeds once in two years. This gives her necessary rest to withstand the strain under rugged desert conditions.

The gestation period in a cow-camel is comparatively longer than in any other domestic ruminant. It varies from 375 to 392 days, average being 389 days. Cow-camel gives birth to one calf at a time.

In a cow-camel, the most characteristic signs of oestrum are restlessness, wandering in search of a male, frequent bleating, swelling of and discharge of mucous from the genital opening. The oestrum lasts for three to four days.

Unlike most ruminants, copulation in camels is effected with the female in the recumbent position with the male squatting dog-like with flexed hindlimbs resting on the ground and the forelimbs extended on each side clasping the female. Both, the male and the female, face in the same direction. The act takes about fifteen minutes and is accompanied by gurgling and frothing by the male and bleating by female. The rest of the herd collects round to hide them from the view.

The most natural sign of pregnancy in a cow-camel is the habit of cocking the tail upwards, when approached by a male-camel or handled by a man. This sign, after fifteen days of service, is the surest indication of pregnancy. At about six months after conception, the belly of the cow-camel becomes enlarged.

The chief indications of approaching parturition are increase in the size of the udder, swelling around the genital opening, sinking of the ligaments of the pelvis on both quarters, and the formation of a groove on each side of the root of the tail.

The cow-camel usually calves in the sitting position. She should not be left loose at the time of parturition otherwise she is likely to run about frightened and endanger the life of the calf.

At birth, the forefeet of the baby-camel come out first with the head resting between the forelegs. At the time of calving, nature should be allowed to have its own course. As far as possible, unnecessary interference should be avoided. The after-birth normally comes away either with the foetus or half-an-hour or so after.

After calving, the calf should be wiped clean and directed to the dam's teats. Unlike other animals, the cow-camel never licks the new-born baby. She, however, takes good care of the calf otherwise and protects it well.

The first three weeks of life in a new-born camel is the most critical period. Great care should be taken that the calf does not take milk in excessive quantity. The camel calf begins to graze very early in life, generally when it is four to six weeks old. The calf is weaned at about fifteen months of age.

The cow-camel is milked twice a day. It usually continues to give milk from ten to eighteen months, average being fifteen months. Besides the milk required for the calf, she may give about nine litres of milk daily. In a full lactation she may give up to 2,750 litres or more. When properly fed and looked after, a camel may prove to be a potent source of milk in desert regions.

The camel's milk has a pleasant taste. It is very much similar in composition to that of cow's milk except that it is a little richer in sugar. Butter can be made out of camel's milk only with difficulty. Camel's milk is frequently used for infant feeding. It is considered extremely sustaining. The average composition of camel's milk is 86·57 per cent water, 4·0 per cent protein, 3·07 per cent fat, 5·59 per cent sugar, and 0·77 per cent minerals.

FEEDING OF CAMELS

The camel is a herbivorous animal and lives by browsing on trees, shrubs and bushes. It likes to graze on tall, young and succulent grasses.

A camel at rest can thrive solely on grazing and browsing. But to meet the requirements of its large body, the time spent on

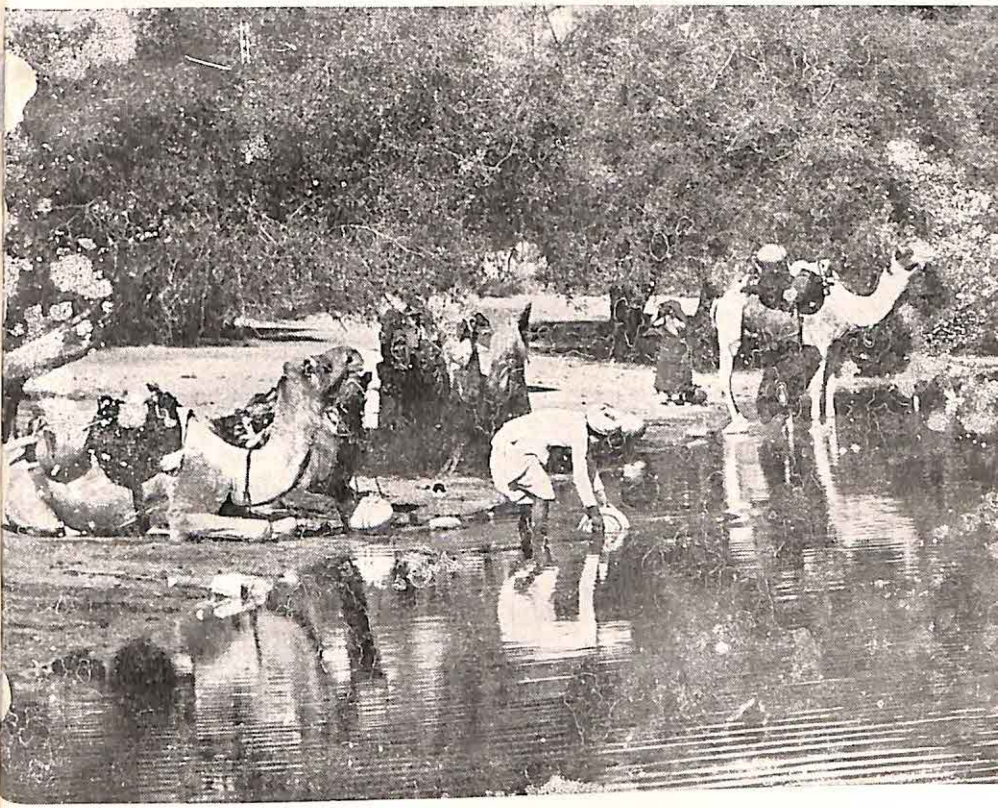

Fig. 13. Camels are Useful in Many Ways—Carry Water in Marwar
(*See page 91*)

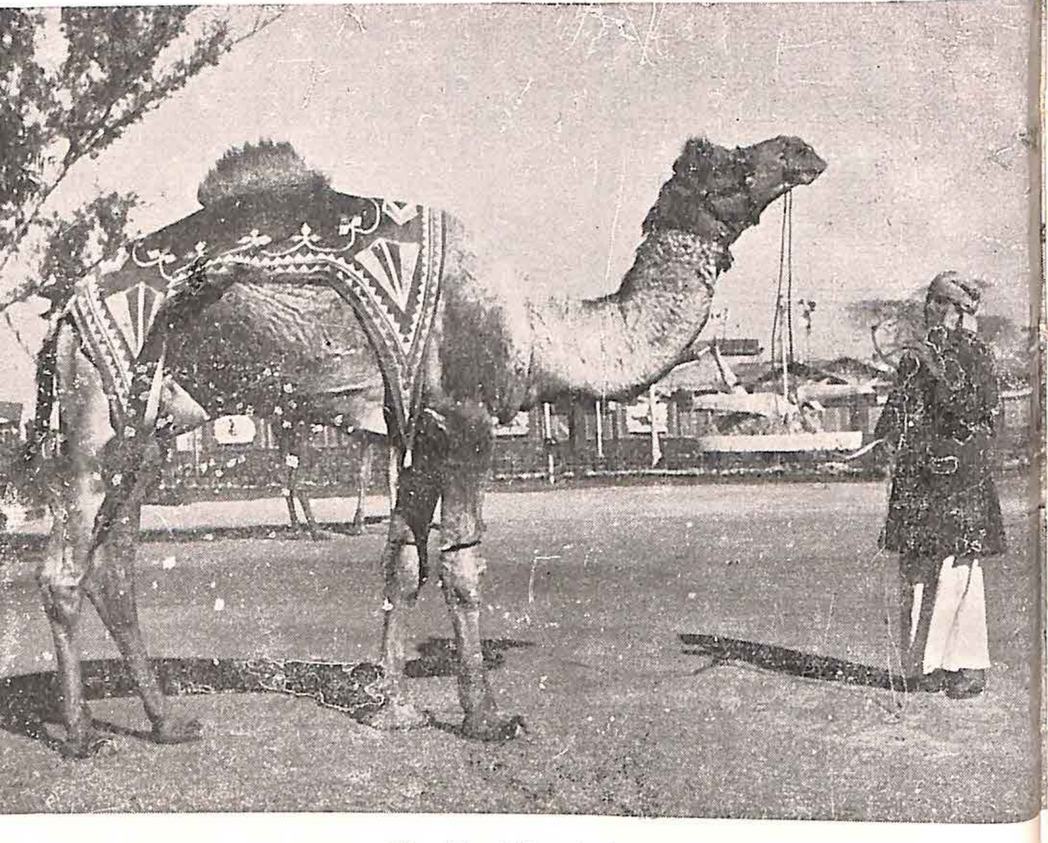

Fig. 14. A Female Camel
(*See page 95*)

browsing and grazing should not be less than six to eight hours a day. The size of the hump of a camel is a good indication of its nourishment. The hump increases in size when ample feed is available.

When sufficient grazing is not available, it should be supplemented by stall-feeding. The supplementary ration may be in the form of green or dry fodder.

A continuous feeding of dry fodders renders the camels prone to indigestion and skin diseases. Dry fodder, as a rule, should be a supplement and not a substitute for grazing. Unless the fodder is very succulent and short, it should be fed in a chaffed condition. This helps avoid a good deal of wastage. When changing over from dry fodders to green, care should be taken that the camel does not over-eat, otherwise flatulent colic may occur which may prove fatal. Changes in diet should be brought on gradually. Sudden changes in feed are a common cause of ill-health in camels. When starting on any new kind of fodder, it is advisable to start by mixing it with the fodder to which the camel has been accustomed and gradually increase its quantity. Enough time should be allowed daily to camels for cud-chewing.

The forage crops generally fed green to camels are *moth*, *mung*, *guara*, *shaftal*, *senji*, *sarson*, *taromira*, green pea and bean plants. The principal dry fodders used in camel feeding are wheat *bhoosa*, barley straw, dried leguminous forage crops like gram, *moth*, *mung*, *guar* and chopped millet stalks. The desert plants which are relished by camels are *Babul*, *Pilu*, *Farwan*, *Kareer* and *Jhand*. Camels are specially fond of the leaves and young shoots of *Phullahi*, *Khair*, *Ber*, *Sheesham*, *Neem*, *Shahtoot*, *Banyan*, *Peepal*, and *Mango* trees.

When a camel is at heavy work and sufficient grazing is not available, it is necessary to feed grain ration. Gram, barley, oats, beans, maize, cottonseeds, and bran are commonly fed to camels. Gram is considered to be the best feed. Grains should be given crushed, but if that is not possible, they may be soaked in water for sometime before feeding. A daily ration of one kilogram crushed gram, one kilogram crushed barley, nine to eighteen kilograms green fodder, seven kilograms *bhoosa* and 28 to 56 grams common salt is considered adequate for a stall-fed camel at medium work.

Because of their biting habit, more than one camel should not be permitted to feed from the same trough. This practice also leads to a great deal of waste. The weaker animal does not get its fair share and the food is eaten too quickly, resulting in digestive disorders.

Grains should preferably be fed in the evenings. They should not be fed on empty stomach or soon after quenching a long thirst.

Salt is essential for keeping the camel healthy. It may be given mixed with daily grain ration or alone. If given alone, it is fed generally first thing in the morning. If given with the grain, it is fed in the evening.

Camels are periodically fed special mixtures and *Masalahs* after hard work, particularly in winter. 250 grams of a mixture made of three parts *Ajwain*, two parts *Kali ziri*, two parts *Kala namak*, one part *Methi*, and one part *Karru* is commonly given in a powdered form twice a month. Sometimes a mixture of 32 to 50 grams of Alum, along with 600 to 700 grams of *Gur* is made into a ball and given to the camel.

WATERING OF CAMELS

A camel can tolerate a loss of water corresponding to thirty per cent of its body weight when exposed to the severe desert heat, while other mammals under similar conditions would die from circulatory failure even when water loss involved is only twelve per cent of body weight. The increased tolerance of the camel to the water deprivation for a prolonged period is due to its power to hold more water in the blood plasma, which is the highest amongst the ruminants. Water elimination through urine and faeces in camels is also comparatively very meagre.

Because of all these factors, a camel can go without water for much longer period than other animals do. A camel, on an experiment, was kept on dry food without water for a period of seventeen days in hot summer and thirty days in winter and was found fit. But under normal conditions, the camels should be given water regularly once or twice a day. Watering every alternate day is commonly practised in desert areas.

Camels have very high drinking capacity. They may drink as much as 135 litres at a time. As they drink water, the red cells in the blood stream swell as much as 240 per cent of their normal size, while in other animals, the cells will burst down causing death if their total volume is increased to more than 130 per cent. The danger-level in men is 165 per cent.

The quantity of water required for the camel varies according to the type of feed, the climate and working conditions. Generally, a camel requires 18 to 36 litres of water, if watered daily, but it may drink more after being without water for a long period.

The water given to camels should be fresh and clean. Camels prefer still water or slowly flowing water to that of running streams. Water should be given before feeding, and after unloading. Camels take their own time at watering and do not drink their fill all at once. A very thirsty camel may sometimes suffer from over-distension after a quick long drink.

HOUSING OF CAMELS

Camels, like any other domestic animal, need adequate protection against draughts, sun and rain. During summer months, camels may, however, be kept in the open. A portable feeding trough should be provided, preferably under a good shady tree. A sand bedding on which a little water is sprinkled in the evening, is considered comfortable for the night rest.

Ordinarily, camels should be housed in a well-ventilated shed. It should, however, be simple and not very expensive. The shed should be constructed on a plot of land at a higher level than the surroundings, so that there is natural drainage of rain water. A camel-shed is usually a three-walled enclosure, open on one side. The open side should not face the direction of the prevailing winds. The roof may be made of tiles or a thatch. The walls may be made of mud. The floor may be *katcha* but should be well-rammed down to render it as non-porous as possible. The floor should have a slight slope backwards, with a drain at the end. The feeding manger should be of *pucca* bricks, and should be at a height of about eight centimetres from the ground.

MANAGEMENT OF BAGGAGE CAMEL

Camel is comparatively a slow maturing animal. A camel at the age of eight years is in very much the same state of maturity as a horse at five years. It is not a sound practice to work a camel under five years of age and must never be put to heavy and strenuous work until it attains an age of six years.

A baggage camel can be broken in at any age after two years. Earlier the animal is handled, easier will be the breaking. To start with, the young animal may be allowed to travel unloaded with the adult pack camels, so that it may get accustomed to the track and to handling. The nostril should be pierced for the nose-peg at least a month before it is intended to start breaking the camel.

The young camel should be taught as to how to keep to the line of march. This is done by tying a rope first around his neck and then to the neck of a quiet but strong camel. The young camel is trained to lead from the nose-rope independently and subsequently by tying it to the tail of another camel in the column. Camels generally work with the nose-rope in single file.

A camel may carry up to four quintals of load, depending on the size and breed of the animal and the distance to be covered. An average load for an adult camel is two to three quintals. The maximum load in the army is, however, limited to 1.8 quintals. Cow-camels take less than this. Whenever a rapid march is desired, lighter loading should be done.

The distance which may be covered during a day depends on the nature of the road, the pace, and the nourishment available. A camel under load should not be required to work for more than eight hours a day, and never more than six hours at a stretch. An average distance for a day's march is 19 to 24 kilometres. A well-looked after camel may easily do 32 kilometres in a day. Camels on the march should be allowed one day's rest in a week.

A comfortable pace for loaded baggagers on a good road is three to five kilometres an hour. A single camel, or a string of three camels, moves faster than a caravan.

The best time for marching camels is at night or in the early hours of the morning. Night-marching is often preferable, due to avoidance of the hot sun and to facilitate grazing. This helps in reducing ration expenses and the need to carry fodder. But night marching should be adopted only when there is sufficient moonlight and grazing is in abundance.

A halt should be made for a few minutes after every twelve to sixteen kilometres to enable the animals to get rest and to urinate. The act of urination in the male camel takes a considerable time.

As a rule, camels should never be kept standing under load longer than necessary. During halts they should preferably be allowed to sit. As soon as the destination is reached, the pack should be unloaded. The saddle or *palan* should not be removed immediately on arrival for if this is done, the sudden removal of pressure from the back would lead to the congestion of skin which may cause a sore back. In chilly weather, if the saddle is removed before the animal has cooled down, it is liable to contract cold, resulting in pneumonia or paralysis.

When deep rivers are to be crossed by swimming, it is best to let the camel cool down by giving him rest before the crossing is made.

Great care is necessary in properly loading a baggage camel. The load should be equally divided and balanced on both sides of the hump. The saddle or *palan* should be squarely and evenly adjusted.

MANAGEMENT OF RIDING CAMELS

The best age to break a camel for riding is three years. Pace must be practised at an early age. However, a camel should not be put to any regular work till he has attained the age of six years. Cow-camels often make excellent mounts.

A riding camel is first taught to kneel to order and to submit to saddling. In the beginning, it is mounted in the sitting position and later on it is led about while mounted and taught to follow and obey the commands conveyed by the reins. While riding, the camel should never be struck on the neck. The proper place to tickle a camel is just behind the right leg of the rider. The tail of a riding camel should be tied to one side by a thin rope fastened to the saddle.

The riding camel is seldom ridden at walk. A good riding camel can cover very long distances, 60 to 80 kilometres a day, for ten to fifteen days at a stretch. After this, it should be allowed sufficient rest. A well-fed riding camel, on an average, can do 40 kilometres a day without any fatigue. An average speed of a good riding camel is eight to eleven kilometres an hour.

MANAGEMENT OF DRAUGHT CAMELS

Camel is commonly used in India for different types of draught work. It is considered especially useful for the plough and the Persian wheel, as a single camel can do the work of a pair of bullocks. Different types of harnesses are used for the camels, according to the nature of the draught work. With an ordinary harness, a camel will draw a cartload of about three quintals. But harnessed to a properly constructed cart, it will be able to draw easily eight quintals.

The best age for putting a camel to draught is five years. A camel when used for ploughing or for working Persian wheel, should not be worked for more than six hours a day, four hours in the morning and two hours in the afternoon.

SEASONAL CLIPPING OF HAIR

In areas where camels grow a long coat, camel hair is considered valuable for a variety of uses. The finest hair is obtained from the young camel or from an animal in a wild state. The camels are generally clipped in the spring season. A camel clipped in spring yields, on an average, one to one-and-a-half kilograms of hair, but in countries in the colder regions, the clip may weigh up to five kilograms per animal.

Clipping is carried out by means of hand-shearing. Care should be taken to shear as close to the skin as possible and without injuring the animal. In working camels, the seat of the saddle should be left unclipped as a preventive against galls. Calves should not be clipped till the monsoon breaks, to afford them protection against hot winds. The clipped animals should be covered with a blanket in case the nights are cold.

As a precaution against the attack of skin parasites, *taramira* or *sarson* oil is usually smeared all over the body of the camel after it has been clipped. It is a very desirable practice, especially when the winter coat is heavy. After the application of the oil, the animal should be kept in the shade, as exposure to the sun may sometimes cause blistering. Two days after the application of oil, the whole body is smeared over with mud, which is removed by stripping off after three days.

DETERMINING THE AGE OF A CAMEL

It is much easier to age a camel than a horse by looking at its teeth. In a camel, from 8 to 12 days after birth, two central temporary incisors appear. At the age of 12 months, there are six temporary incissors. These start wearing at four years of age, and the temporary incissors are nothing but stumps. At the age of five years, there are two permanent incissors. At six years there are four permanent incissors, and at seven years there are six permanent incissors. When the camel is eight years old, the tushes appear.

A camel in full mouth has ten molars and six tushes in the upper jaw and eight molars, six incissors and four tushes in the lower jaw.

After the camel is nine years old, the age is determined by the wearing of the tushes and the shape of the incissors. After eleven years, the finding of the age of a camel becomes largely a matter of guess-work. As age advances the tushes become worn, the incissors instead of being thin and elongated become rounder and shorter, until in very old age they are nothing but stumps.

After the camel is about twelve years old, the long hair bordering the tail become grey. The skull is more massive in the old camels than those in middle age.

Camels, like horses, may live to the age of 40 years or more. The working life of a camel, however, varies greatly, depending on the feed and care given. Generally, it is about fourteen years, varying from six to twenty years.

SIGNS OF ILLNESS IN CAMELS

Camels suffer from almost all those diseases from which other ruminants commonly suffer.

The most important symptoms of diseases in camels are rise in temperature, shivering, partial or complete loss of appetite, cessation of rumination, dullness, pendulous lips, restlessness, watery discharge from half-closed eyes,hollow flanks, and quickened pulse and respiration. The urine is high-coloured and usually scanty. In females the yield of milk is greatly diminished. The sick animal prefers to stand facing the sun.

The normal temperature of a camel is 36·1 degrees C (97 degrees F) in the morning. It rises considerably from dawn to sunset. At sunset the average temperature is 37·9 degrees C (100·3 degrees F). The temperature in camels is taken inside the rectum when the camel is in the sitting position. An ordinary clinical thermometer is used for the purpose.

In the healthy adult camel, the normal pulse rate varies in the early morning from 32 to 44 beats per minute, and in the evening from 36 to 50 beats. The pulse can be felt on the underside of the tail near its root or about eighteen centimetres above the inner side of the point of the hock.

The normal frequency of respiration in healthy camels at rest is variable from five to twelve per minute. In cold weather it is less and does not go beyond eight.

COMMON DISEASES OF CAMELS

Surra, which means rotten, is the most common and fatal disease of camels. It is endemic to almost all the camel inhabited areas in India. The disease spreads from the affected camels to healthy ones, through the agency of biting and blood-sucking flies. The disease occurs generally during the monsoon season when flies are most abundant.

In camels, Surra may take an acute or a chronic form. The latter form is the more prevalent. In the acute form, the disease runs a rapid course and the animal dies in a few months. In the chronic form the disease is of long duration and may last three to four years.

A camel suffering from acute form of Surra shows signs of loss of appetite, hollow flank, and drooping neck. The animal stands listlessly with eyes half-closed and a watery discharge coming from them. The temperature is nearly always above normal, generally between 37·2 and 39·4 degrees C (99 and 103 degrees F) in the morning. Cow-camels go dry and if they are in calf, abortion often occurs.

In the case of chronic form, the typical symptoms are remittent fever, anaemia, and emaciation. The animal gradually becomes more and more emaciated, till it finally becomes nothing but skin and bones and the hump almost disappears.

Anthrax in camels is more common than it is usually suspected.

The main symptoms of Anthrax are rise in temperature, cessation of rumination, and rapid breathing. The camel sits down and is unable to rise. The death takes place within a few hours. The disease is characterised by its rapid course and it may be suspected when sudden deaths occur in animals.

Preventive measures include segregation of in-contact animals. The carcass and the gear of the affected animal should be burnt and the place thoroughly disinfected. No camel should be allowed to graze in the area where anthrax cases have occurred.

Rabies is transmitted to camels by the bites of rabid dogs, jackals and wolves. The symptoms in the camel may develop from a few days to two months after being bitten by a rabid animal.

The typical symptoms of this disease in camels are aggressiveness, eyes have a queer glassy look, nose is carried high and saliva dribbles from the mouth. Sometimes paralysis may occur.

The affected animal should be destroyed. The carcass should be burnt. A rabid camel is a great danger to man and beast.

Camel-pox is a very contagious disease in camels. It generally affects young camels before they are two years old.

The most common symptoms are lesions on the skin of upper and lower lips. In serious cases, the lesions may spread to other parts of the body such as the face, upper eyelid, head, throat, neck, hind legs and feet.

The affected animals should be segregated and separate attendants should look after them. Gear used for sick animals should be thoroughly disinfected.

Kumree is a disease of camels, in which the animal is able to assume the sitting position with great difficulty.

It is characterised by the quivering and trembling of the muscles of the hind quarters, when the camel assumes the sitting position.

A camel once showing signs of *Kumree* seldom recovers.

VII

ELEPHANTS

INTRODUCTION

ELEPHANT is the largest and most majestic of all animals tamed by man. Elephant is often mentioned in the ancient Indian literature. It figures prominently in the traditions and religions of the country. In Hindu mythology, *Ganesha* is depicted as elephant-headed god.

The elephant inhabits the forest districts of India, Ceylon, Assam and Burma. It is also found in Malay Peninsula, Siam, and Cochin China, as well as in the islands of Sumatra and Borneo. Although South-Eastern Asia is considered to be the probable original home of this animal, elephants are found in large numbers in Africa.

The Indian elephant differs from its African counterpart in being smaller animal, both in height and weight. It has smaller ears and unlike African elephant, has concave profile of the back.

In India, elephants are mostly found along the foot of the Himalayas as far west as the valley of Dehra Dun. In the great tract of forests between the Ganges and Kistna rivers, they occur locally. They are also found in Western Ghats and in the hill forests of Mysore and Assam.

No census is available as to the number of elephants in India. Rough estimates indicate that there are about 7,000 wild elephants, of which about 3,000 are believed to be in South India alone.

The elephants have long been captured for domestic uses in India. In the past, they were mainly used as beasts of burden and for military purposes. Elephants are considered indispensable in the timber industry. They are employed in forest tracts in hauling the logs to the banks of streams for transport. They are also used for riding in thick jungles. Tuskers are valued for their ivory. Elephants form a featured part of menageries with the travelling circuses. Till recent years, elephant constituted an important sign of royalty with the chiefs of the native States who displayed them with pride on festive occasions.

In the wild state, the elephant has always been a great attraction for the hunters of big game. In India, the elephant is employed in tiger-hunts.

GENERAL CHARACTERISTICS OF ELEPHANTS

Intelligence and memory in elephants have sometimes been grossly exaggerated. These senses, in elephants, are not much better than that of a dog or a horse. The skin of the elephant is of considerable thickness, about two centimetres or more, but is extremely sensitive. The thickness of the skin varies in different parts of the body. It is thickest about the loins and the buttocks. Vision, in elephant, is acute, but the animal is generally handicapped in making use of his eyes. The neck being short, does not permit the head to turn sideways sufficiently to see objects at the rear. The limited field of vision is, however, fully compensated by extremely keen sense of smell and hearing.

Elephant generally gets startled by any unusual sound or noise and often starts blowing a forceful blast of air through the trunk producing the sound, familiarly known as *trumpeting*. An elephant, when about to charge, also gives vent to a shrill trumpet.

Indian cow-elephants, as a rule, do not have tusks. Many bull-elephants are tuskless and are known as *makhanas*. The tusks, in elephants, do not correspond to the tusks of a wild boar, but to one of the pairs of incisors. The tusks arise from the upper jaw, and grow throughout the entire life of the animal. These are formidable weapons of offence. They can be brought into use at almost any angle. They can otherwise be very usefully employed and enable the animal to perform a variety of work which cannot be undertaken without them. The longest specimen of tusk recorded is 2·6 metres and the highest weight as 46 kilograms.

Usually, the Indian elephant has five polished hoof-like nails on the fore feet and four on the hind feet. Unlike horse, the only pace of the elephant is a walk. A moderately loaded animal can, on a good road, travel nearly five kilometres in an hour. A ditch about two metres wide and 1·8 metres deep is impassable for him. Elephants are, however, good and powerful swimmers.

Elephants attain a much longer age in the wild state than in captivity. Sometimes, extremely exaggerated ages are attributed to elephants. Normally, an elephant of 25 to 35 years of age is considered young. From 35 to 45 years is considered full-grown and from 45 to 50 years middle-aged. From 50 to 60 years, it is considered on the decline, while at the age of 70 or 80, it is very old animal. The average age of a circus elephant is about 35 years.

The age of an elephant can be approximately judged by the amount of turn-over of the upper edge of the ear. In young elephants, sometimes up to the age of eight or nine years, the edge is quite straight. It then begins to turn over, and by the time an animal is 30 years, the edges curl over to the extent of 2.5 centimetres. Between 30 and 60 years, the turn-over increases to 5 centimetres or slightly more. Teeth also afford some rough evidence as to the age.

Extravagant estimates of the height of elephants have, from time to time, been recorded. Roughly speaking, about 2·7 metres should be considered good height for large males, and 2·4 metres for females. The average height of the circus elephant is 2·2 metres.

A large elephant weighs over 3,630 kilograms. The average circus elephant weighs 2,720 kilograms, ranging from 1,040 to 4,170 kilograms.

There is a general impression that the body of the elephant is incessantly active. Many elephants stand for hours at a time shifting the weight back and forth called *weaving*, but otherwise the body, as a whole, is relatively quiet. The smaller parts of the body such as tip of the trunk, ears and tail are, however, often in continual activity. Nearer to the tip of the trunk the activity is greater, for the end of the trunk is almost always in motion. The tail is even more active. The movement of the ears is generally believed to represent in large part a nervous reflex, much like the winking of the eyes by humans.

The elephant almost invariably remains standing. It lies down for relatively a short time only during the night and almost never during the day, except when unusually tired.

It is widely believed that the elephants rarely sleep and if at all, for only a short time. Actual observations have, however, revealed that, given the opportunity, they will lie down to sleep, particularly between 11 in the night and 4 in the morning. The elephant may actually doze in the standing position in which case the characteristic position is standing with the head and trunk motionless, and the end of the trunk resting quietly on the ground.

Elephants are valued according to their age and training. Well-trained tuskers command the best price. They prove more useful both in the yards and forests as with the help of their tusks and trunk they can stack timber, carry logs over obstacles, and are valued for the thickness and sweep of the ivory.

The chief characteristics of a good elephant are medium height, broad chest, wrinkled skin as that of a crocodile, massive head, broad forehead, large ears, bright eyes free from excessive flow of tears. The trunk should be of good length, broad at the root, and covered in front with pinkish coloured spots. The neck should be short, thick and full. The back should be straight and broad. Forelegs should be short and convex in front. The hind-quarters should be full, sloping and supported by thick short limbs. The pads of the feet should be hard, nails smooth and polished and paces fast and easy. The tail should be long with a good tuft and bristles.

High arched back, very prominent spinal ridge, thin and light coloured skin and long legs are considered undesirable points in an elephant.

BREEDING IN ELEPHANTS

Very scanty information is available regarding the reproductive pattern of elephants. As a rule, they rarely breed in captivity. Elephants who are permitted to graze about in the jungle or are let loose in forests during nights, lead a more natural life and co-habitation among them may occur. Cases of wild elephant-bulls covering tamed female elephants in forests are not infrequent

The age of reproductive maturity in elephants varies from 8 to 15 years. They, however, continue to breed till they reach the age of about 70 years.

In the wild state, cow-elephant breeds about every two and a half or three years and in her life time may give as many as 15 calves, or even more.

Musth is a condition in elephants which has not yet been fully studied and explained. Tamed bull-elephants usually come into *musth* regularly each year and remain in this condition for about three weeks. It is sometimes described as an instinctive desire in the male elephants to fight and even kill before mating. Cow-elephants are not temperamentally upset in this condition.

Musth period is regarded as most dangerous and elephants in this condition are known to have killed their own *mahouts*. The elephant should be chained up and fed very cautiously. Elephants are generally given extra work during this period so that the *musth* may pass off quietly.

Dark oily discharge from the glands between eyes and ears does not seem to be co-related to the intensity of *musth*, although marked flow usually appears with it. Both the males and females have these glands.

The sexual activity in the female is at a very low level, and very rarely it shows signs of excitability comparable to that in most of the domestic and other large animals. There is seldom any evidence of heat in the cow-elephants.

The congress in elephants does not differ much from that of the other domestic quadrupeds. Co-habitation is characterised by considerable sex-play before the actual congress. The bull-elephant uses his trunk to fondle the female and occasionally grasps the cow with it. During this process, the trunk, tail and ears of the cow, as well as of the bull, are in constant and rapid motion indicating unusual emotional stress.

The tusker takes a position analogous to that taken by males of other species of mammals during copulation. Often, cow-elephants have been observed to assume a kneeling posture, flexing the fore limbs. The fore-legs of the bull are placed as far as the shoulders, on the either side of the spine of the cow. The male neither grips nor steadies himself with the fore-legs, but gradually sinks on the hind legs till he almost assumes a sitting posture, then straightens the hind limbs and raises himself. The actual copulation lasts only a short time, about one minute or so. No thrust is noticed. After the congress, the tusker moves off and remains silent, while the female is still in emotional mood and trumpets softly, flapping the ears and whisking the tail.

The average gestation period in the female is about 20 months, ranging from 18 to 22 months. Cow-elephants will permit intercourse with bulls even when they are in pregnancy, though it has been usually held that the females will not allow a bull to approach until 8 or 10 months after calving. Twins among elephants are very uncommon.

Considerable enlargement of the mammary glands may be noticed in a pregnant female. Otherwise, she remains normal in general appearance and may endure physical stress of work even when she is in advanced pregnancy. Abortions, caused from undue exertion, have been very rarely reported.

ACT OF PARTURITION IN ELEPHANTS

Normally, the act of parturition occupies short time. At the time of parturition, the female shows signs of restlessness and great agony. She groans and twists the body. The head is often tossed, with the trunk playing in the air.

An hour or so before actual delivery, a discharge may be noticed from the genital passage. When about to give birth, the animal seeks soft ground and peaceful surrounding. In the wild animals, the herd of elephants to which it belongs, shows signs of excitement and a few females detach from the herd to accompany her to the calving spot, usually a thicket, where they stand in guard over her. Shortly after calving, they rejoin the herd.

In the act of parturition, when the first blood clot is passed, the trunk is laid on the ground and the animal quietens. She would twist from side to side and at other times she would put her trunk between the legs and push back, with the fore-legs extended.

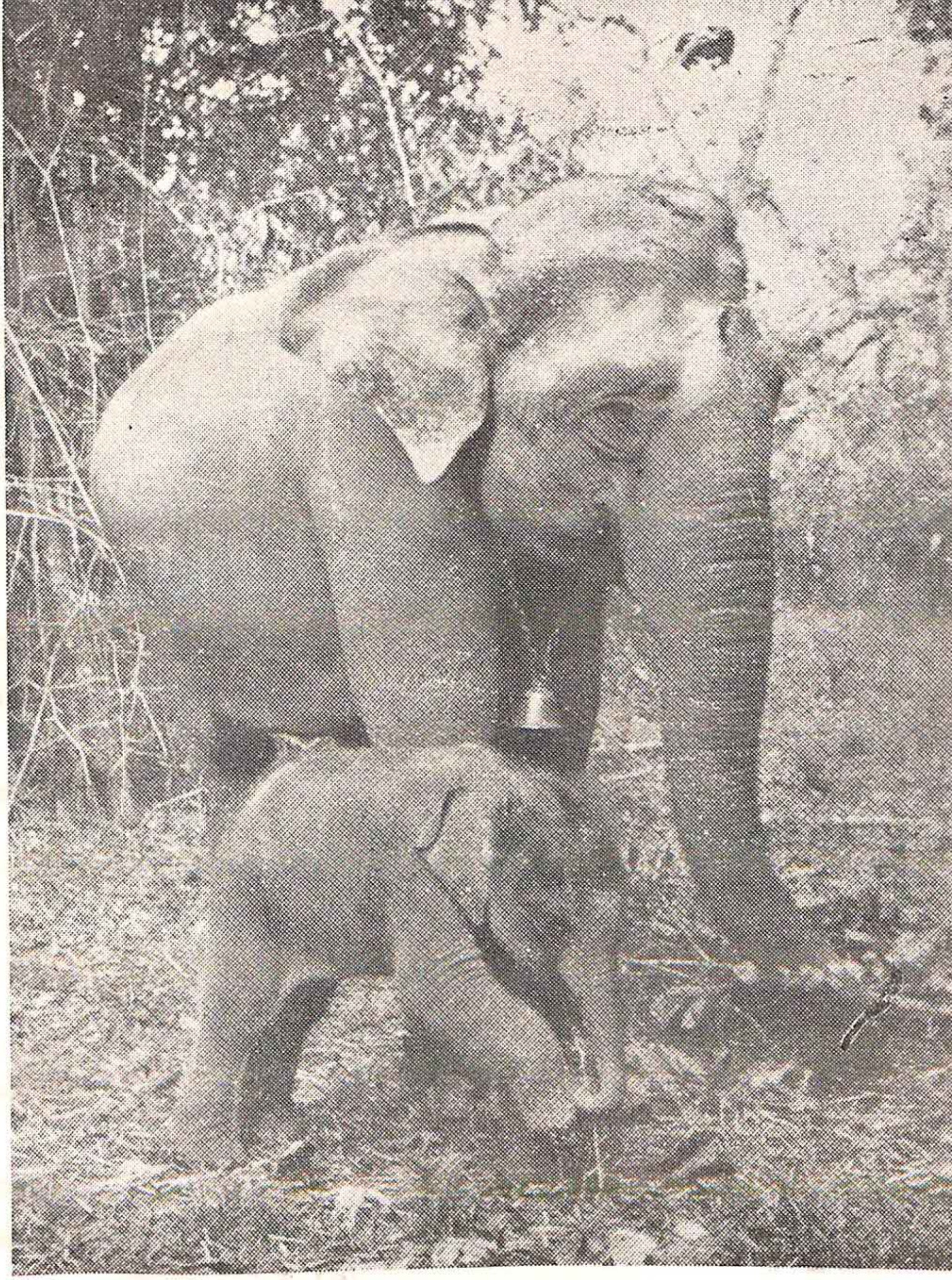

Fig. 15. Mother and Baby Elephant (Kerala State)
(*See page 113*)

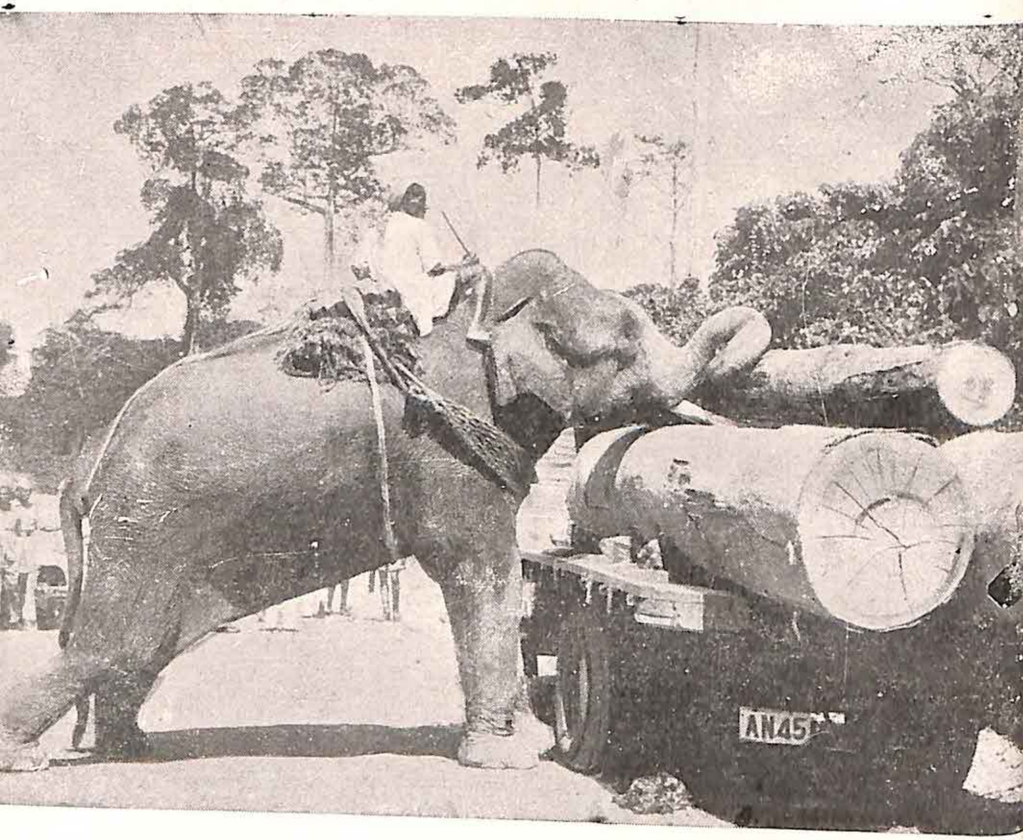

Fig. 16. Elephant Being used for Hauling Logs
(*See page 107*)

She doubles up assuming the posture of defecating dog, with the trunk between forelegs and weight on hind legs. Often a cow-elephant may be seen assuming a recumbent posture during parturition. Deaths are not uncommon due to malpresentations.

The calf may be presented with the head and forefeet first. The foetus is then expelled and as it falls to the ground, the navel cord breaks. The baby elephant remains lying on one side. If the foetal membranes are not ruptured, the cow-elephant will do so with her foot.

The calf is covered with fur all over the body. This is, more or less, a juvenile characteristic in elephants, which is rapidly lost as the calf grows. The baby elephant defecates shortly after birth and lies for one to two hours, occasionally moving ears and trunk, after which it gets on its feet and walks.

The pains for the after-birth begin in one to two hours after calving, and it is expelled within about an hour or two, followed by a large amount of blood and clots. As soon as it is dropped, it is generally eaten up by the dam.

New-born baby elephants weigh about 100 kilograms or three to four per cent of the mother's weight. When compared with the relationship of weight of the baby to that of the mother in the case of animals of other species, the weight of the baby elephant is very small. In human beings, the weight of the infants is approximately six or seven per cent of the mother's weight. In the case of cows, it is little under eight per cent. The height of the new-born elephant is about 90 centimetres at the shoulder.

The young one suckles with its mouth. It soon becomes playful and active. Growth is very rapid at first, and the young baby can walk well enough after a few days to follow the mother on a short march. In the wild state when a calf is born, the herd remains in the vicinity until the young one is able to follow the mother in about 48 hours.

The cow-elephant is usually very devoted to her calf. She never suckles a strange calf. She becomes vicious when she has young ones in attendance. The calf suckles the dam for about two to three years. In captivity, the calves are usually weaned at the age of about one and a half years.

COMPOSITION OF ELEPHANT MILK

Milk of the elephant possesses a characteristic taste and odour. The average sample contains 9·10 per cent fat, 2·51 per cent protein, 8·59 per cent sugar, 0·50 per cent minerals and 79·30 per cent water. In comparison with the average cow milk, it contains about eight per cent more solids and over four per cent more fat. Calves live entirely on milk for several months. They continue to take milk even for some time after they start eating grass.

Udder in the cow-elephant consists of two glands and is situated on the breast just beyond the forelegs. During later period of gestation, it becomes considerably enlarged and may secrete milk sometimes before parturition.

FEEDING THE ELEPHANTS

Elephant's life is said to be one continuous meal. As long as any food is before them, they will go on eating even when the appetite is fully satisfied. In the wild state, elephant has the habit of munching food a good part of the twenty-four hours.

In the elephant, all food is conveyed to the mouth by the trunk. The stomach in elephant is a simple sack unlike that of most herbivora and measures nearly one metre long. The total length of the intestinal tract is about 30 metres. Relative to the enormous size of the animal, the length of the intestinal tract is short. It is almost the same as that of the horse or the mule.

The food passes through the intestinal tract of the elephant fairly rapidly. This is in large partly due to the fact that the elephant is not a ruminant. The length of time that the food remains in the intestinal tract is about twenty-four hours.

In elephants, the intestinal contents represent about ten per cent of the total body weight, which is much less than that of the large ruminants like the ox in which case it is about 40 per cent. The total daily weight of the fresh faeces in elephants is about 110 kilograms. Five or six boluses are passed at one time. These may weigh as much as two kilograms each. The faeces give an impression of a mass of chopped hay. The digestibility of hay is extremely poor as compared with that of other domestic animals.

A single discharge of urine in elephants amounts, on an average, to five litres. The total volume of urine passed in a day is about fifty litres.

The elephant is essentially an animal of forest. Its food largely consists of tree leaves, young and tender bamboo shoots and green grass. Nothing is more conducive than free grazing to its health. Wherever conditions permit, elephants should be allowed extensive grazing and choice of their own fodder. They should, however, not be allowed to graze in swamps or inundated tracts.

In feeding elephants, it must be ensured that the elephants have plenty to eat and that the fodder is fresh, sweet and to their taste. Elephants are fastidious beasts and will not eat all that is placed before them. As far as possible, the fodder should not only be of good quality but must also be varied.

Besides green grasses, the elephants eat branches and leaves of *peepal*, *banyan*, and other varieties of ficus, jack tree, young shoots and tops of bamboo and palms. They also relish sugar-cane, plantain leaves and stems, and fruits such as melons, *bael*, *jack*, pineapples, *palmyara*, coconuts and other wild fruits.

The daily quantity of green fodder required by an elephant depends upon the quantity of dry fodder given. As a rule, each animal should have as much green grass as it can consume. The exact quantity of fodder required is best indicated by the animal's ability to dispose it of during twenty-four hours. Roughly, 160 to 180 kilograms freshly cut grass or fodder should be considered sufficient to meet a day's requirement.

In case of animals in captivity and more particularly in the case of working elephants, some concentrate ration is needed in addition to the grass and other fodder. The concentrate ration usually consists of rice, paddy, and coarse flour. Rice or paddy when coarsely ground is more easily digested. Wheat flour is commonly given after making it into *chapatis*. *Chapatis* are usually sweetened with *gur*. Cooked onions and tamarind pulp are also added, particularly during hot season.

In the army, the medium-sized elephants on command, are allowed a daily ration of 6·8 kilograms of grain, 80 kilograms dry fodder and 180 kilograms green fodder. In addition they are given 56 grams of salt and 28 grams of oil daily. Large animals are provided 90 kilograms of dry fodder and 215 kilograms of green fodder.

The usual ration for zoo animals in India consists of 100 kilograms of green fodder consisting of millets and oats, 75 kilograms of tree fodder such as *peepal* and *neem* leaves, and one kilogram of carrots, according to the season. In addition, they are given daily, five kilograms of wheat bread in the form of *chapatis*, two kilograms of *gur*, 100 grams of common salt and 100 grams of groundnut oil.

Elephants should be allowed to feed at all times except when at work. Before and after work are no doubt the most appropriate times for supplying fresh fodder. Circus animals are fed five or more times a day. The best time to feed concentrate ration is after the ordinary fodder has been consumed.

WATERING

Clean fresh water in liberal quantities is essential for the well-being of the elephant. A full-grown elephant drinks about 190 litres of water daily and requires nearly about 70 litres of water at a time. The elephant sucks up water with its trunk and then pours it into the throat. The entire drinking cycle, that is, taking the water, raising the trunk to the mouth, and discharging the water down to the throat, takes approximately four seconds.

The elephants generally drink water when they go for bathing in the mornings and evenings. If the water available at the bathing place be stagnant, he should be given drinking water from a better source beforehand. Elephants like running water and prefer to drink the water of the tributary streams to that of the large rivers. Otherwise spring or well water is considered the best. On no account should elephants be permitted to drink from the tanks and pools used for cattle. Elephants should be watered at least twice daily, preferably three times. They should be watered about an hour before they are fed. During hot weather, marches should be regulated in accordance with the availability of good water on the way.

General Management of Elephants

As a rule, the elephants are extraordinarily docile and tractable animals and present no great difficulty in handling and training. In spite of their formidable size, elephants are surprisingly quick and obedient and possess remarkable ability to work for man. They are, however, known for their nervousness and excitability. They become panic-stricken without any apparent cause. During their use in warfare, elephants, due to their nervous temperament, often did more damage to the men of their own army by stampeding than they did to the enemy. Elephants need very careful handling.

Although the elephant is a large animal, its power of endurance is much less than is generally supposed. It possesses comparatively a delicate constitution. Unlike other domestic animals which are born and bred in captivity, elephants usually live a natural life for many years till they are captured. They have to work under conditions which are greatly different from their natural habitat. Therefore, they need special care and attention. A little neglect may cause loss of a valuable animal.

The amount of work which may be expected from an elephant must necessarily depend upon individual constitution and the type of work. Generally speaking, during hot weather, elephants should not be worked in the open between ten in the morning and three in the afternoon. When elephants are employed for dragging logs, the best course would be to work them for about three hours in the morning and three hours in the evening. Wherever possible, special dragging carts may be employed to save them from unnecessary exertion.

The elephant is constitutionally a beast of burden. Opinions, however, vary as to the absolute weight an animal can carry. The optimum load may average from 450 to 550 kilograms.

After work, it is necessary that all parts of the body of the elephant liable to gall should be inspected. If the animal has been carrying a load, the attendant should rub the back. The trunk and feet should be carefully examined for cuts, bruises and foreign bodies such as thorns and bamboo spikes. During the rains, the legs should be examined for leeches.

Elephant driving is an art. A good rider should not ordinarily shout at the animal. He should not unnecessarily employ the goad or the driving hook. A good rider controls the animal entirely by word of command and the proper application of the knees and feet when necessary.

Elephants do not like exposure to direct sun. It is dangerous to expose them to the direct sun as they are liable to get sun-stroke. Elephants, when working in the sun, should be provided with some cover to the head and neck. Exposure to rain, provided the drainage be good, does not seem to do much harm. Exposure to cold winds, however, affects their health adversely.

Rest and sleep is very essential for the health of the animal. To keep an animal waiting for his fodder on coming off work is a very undesirable practice. If the animal does not get time to eat sufficient before midnight, it will continue eating all night at the cost of his sleep.

When elephants are idle, it is essential that they have daily exercise. In some cases, the daily journey for fodder will suffice. The best practice is to give them a march an hour or so in the early morning and evening.

The elephants are generally captured in a stockade, in *khedda* operations.

SHELTER FOR ELEPHANTS

Elephants need artificial shelter only where good natural shelter is not available. The best shelter is grove of evergreen trees with a good drainage. There should be sufficient space for the standings which should be frequently changed. For elephants working in yards, sheds are necessary. They should be erected on sheltered and well-drained sites and have raised sloping floors of concrete or laterite. Floors made of wooden planks are not suitable as they usually get soiled with urine.

In selecting camping ground for elephants, it is essential that the ground be sloping. The elephant should face with head uphill, otherwise if they lie down they might experience great difficulty in rising. The standings should not be on uneven gound and should be free from stones and stumps.

Bathing

Regular bathing is most important to keep elephants healthy. No animal delights more thoroughly than the elephant in a bath. In the wild state, the animals pay daily visits to deep cool pools in hilly streams and even large rivers. Elephants are excellent swimmers and by means of their trunks are able to breathe without difficulty when the entire body is submerged.

For bathing elephants, the water should be deep enough at least to permit immersion of the whole body in the crouching position. Elephants should, on no account, be kept in places where facilities for bathing are not available. They should preferably be taken into the water for bath shortly after daybreak and at sunset. While bathing, the attendant should rub the body over with a soft stone or the husk of a coconut.

Sickness in Elephants

Elephants generally do not fall sick, provided they receive proper care and attention. They are, however, considered bad patients. Their vital processes being slow, the disease takes a protracted course and it takes a long time to regain loss of condition.

The normal body temperature of an elephant varies from 36·3 to 36·6 degrees C (97·4 to 98 degrees F). In elephants, a temperature of 37·8 degrees C (100 degrees F) indicates considerable fever. A rise in temperature of two to three degrees centigrade is considered grave.

Temperature in elephants is taken by insertion of a thermometer into the rectum. Ordinary clinical thermometer is used but care should be taken that the thermometer is inserted well into the rectum and is kept there for at least a minute. Special thermometers suitable for this purpose are also available.

The normal respiration rate in elephants is about ten when standing, and four to five when lying quietly. The normal pulse rate is 28 per minute while standing, and 35 per minute when lying down.

The first indication of a sick animal is the cessation of the usual movements of the trunk, ears, limbs and body, so characteristic of health. The animal looks dull. Appetite may be partially or completely lost. There is rise in temperature. The other signs of illness are, dryness of mouth, constipation, scanty and deep-coloured urine, watery and reddened eyes, acceleration of the pulse and general depression.

GENERAL PREVENTIVE MEASURES

Whenever there is any indication of illness, the animal should be given sufficient rest. During the hot season, a cool and shady place should be provided. During rainy season, the animal should be protected from getting wet and exposed to cold winds. All grain ration should be withheld. Coarse and dry fodder should be avoided. As far as possible, only freshly-cut green fodder should be given. Water should be provided in sufficient quantities and the elephant should not be moved over a long distance for watering.

In case of a contagious disease, the animal should be immediately isolated from healthy animals and removed to a fresh standing. The premises should be thoroughly disinfected. All utensils and equipment should be sterilised. The infected litter should be disposed of by burning. The carcasses of dead animals should be buried deep.

COMMON.DISEASES OF ELEPHANTS

Anthrax is a contagious disease commonly reported among the elephants, It generally occurs during rainy season and takes a severe and rapid course. This disease is characterised by rise in temperature and bleeding from the mucous membranes.

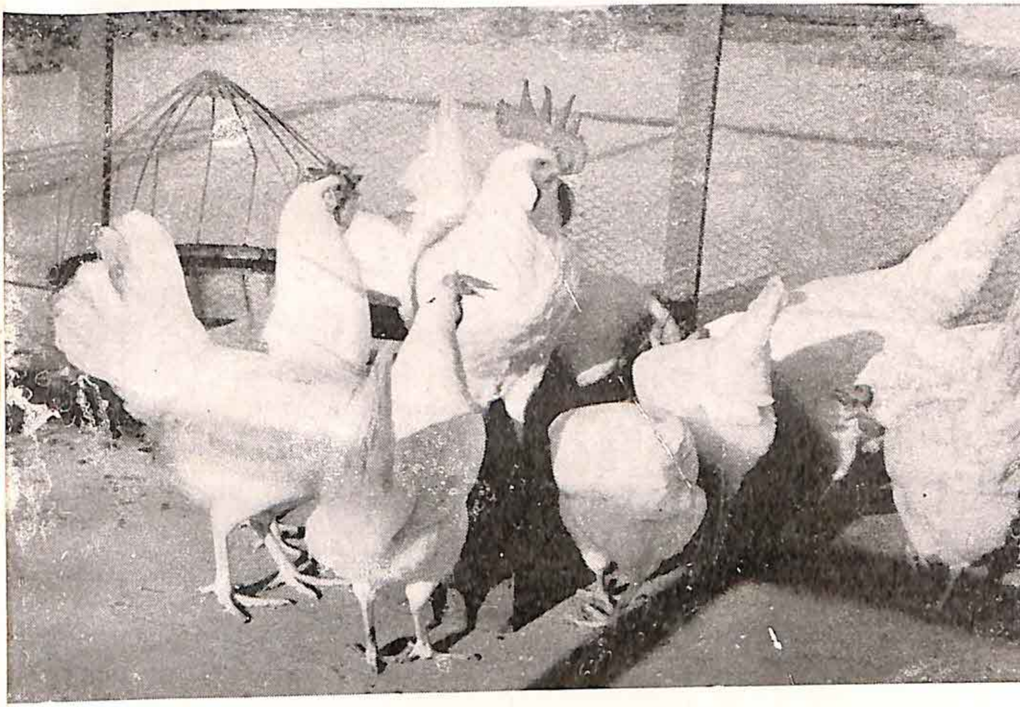

Fig. *17.* White Leghorn Fowls
(See page 126)

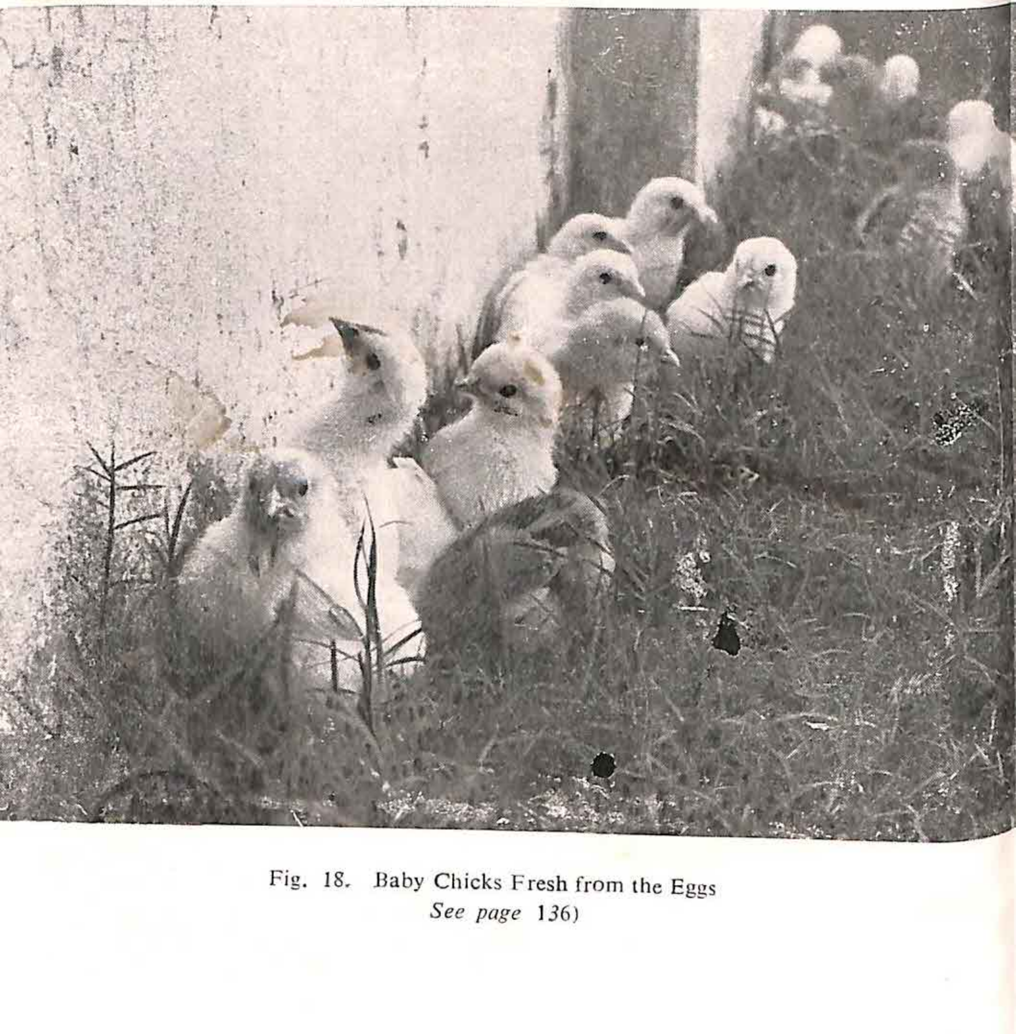

Fig. 18. Baby Chicks Fresh from the Eggs
See page 136)

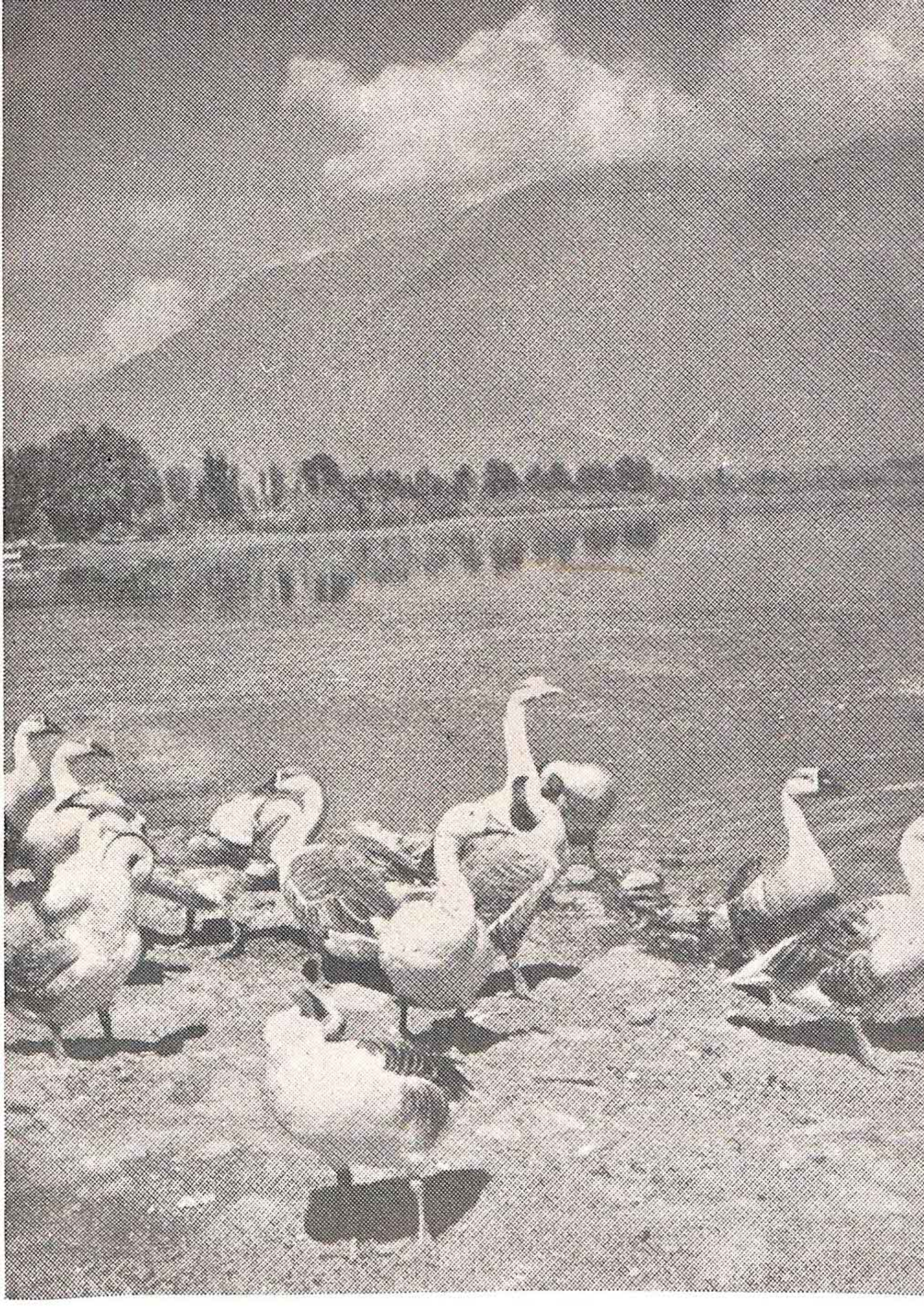

Fig. 19. Ducks Are The Most Important Kind of Poultry Next To Chickens
(*See page 142*)

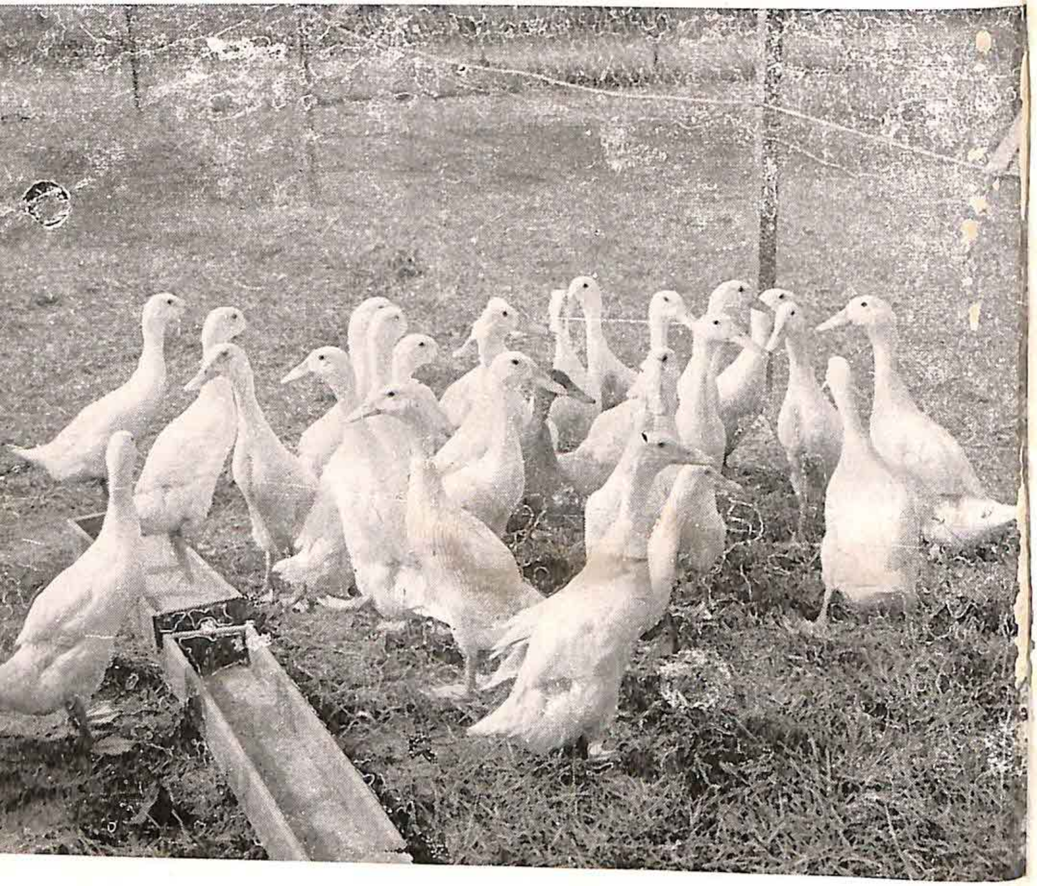

Fig. 20. A Flock of Indian Runner Ducks
(*See page 143*)

Preventive measures consist of immediate segregation of sick animals and thorough disinfection of the contaminated place. The infected litter should be disposed of by burying. The carcass of the dead animal should not be cut upon and should be buried deep.

Haemorrhage Septicaemia is a highly infectious disease. It is most prevalent during the early rains or towards the close of the monsoon. The general symptoms of the disease are complete loss of appetite, mouth being usually kept open, the trunk contracted, high fever and swellings in the head, neck, shoulders and between the jaws. Diarrhoea may also occur. The urine is scanty, high-coloured and turbid.

Apart from general preventive measures, treatment is not of much avail.

Trypanosomiaris or *Elephant Surra* is characterised by intermittent and sometimes a relapsing type of fever. Elephants become dull and are disinclined to move about. The mucous membranes are pale and may take a yellowish tinge. The urine is scanty and markedly greenish in colour. Animal loses condition gradually.

Preventive measures consist in avoiding camping in marshy localities and protecting the animals from the bites of flies.

Foot and Mouth disease has been reported among elephants. The characteristic symptoms are soreness of the mouth, rise in temperature, the animal is wholly off the feed, vesicles appear on the tongue, cheeks and mucous membrane of the trunk. Loss of condition takes place due to inability of the animal to eat. When feet are affected, they become swollen and tender and cause the animal to limp.

It is an infectious disease. Attention to hygienic and sanitary conditions is essential. Mouth and feet of the affected animals should be washed three or four times daily with some mild astringent lotion. The disease is not a fatal one, but if proper care is not taken, it may result in serious dislocation of work.

Elephant Pox is a specific fever characterised by eruptions somewhat similar to small pox in man. There is rise in temperature and the animal becomes weak and listless. The eruptions begin as pimples, then become blisters with clear fluid contents. Finally they burst, leaving sores which tend to scab.

It is an acute and highly infectious disease. The sick animals should be isolated and the premises should be thoroughly disinfected.

Rabies among elephants may be caused through bite of a rabid dog. Jackals and wolves may also communicate the disease. The early symptoms are excessive restlessness, trembling, convulsions and tendency to break away. The animal shows lack of appetite and desire to drink water. The animal frequently screams, utters unusual sounds and may become furious and violent.

The animal should be removed to a distance from habitation, well secured and kept under constant observation. On manifestation of violent condition, extra shackles should be applied and the animal destroyed without delay.

VIII

POULTRY

INTRODUCTION

INDIA and its neighbouring countries are the ancestral home of the present-day .domestic fowl. The ancient man was attracted to it both for food and sport. Cock-fighting was known in India over one thousand years before Christ.

Poultry includes several kinds of birds, such as chicken, ducks, geese, turkeys, and guinea fowls. In India, of all these birds, the chicken or the domestic fowl is the most important.

Poultry farming plays an important part in the rural economy of India. It provides a ready source of income to the cultivator. Besides meat and eggs, poultry supplies feathers and rich manure. Both the initial expenditure and the recurrent cost of maintenance of birds are so low that they are within the easy reach of an average cultivator.

The importance of poultry in India, in raising the low nutritional standard of its population, cannot be over emphasised. The eggs and the poultry meat are one of the richest sources of proteins and vitamins. The average Indian diet is extremely deficient in both of these. Poultry, therefore, offers the most economical and quickest means of increasing the production of high quality protein food in the country.

PRESENT POSITION OF POULTRY IN INDIA

In India, there were 115.45 million poultry birds, including ducks and others, in 1966. This number increased to 13.54 million in 1972 and to 159.22 million in 1977. This showed an increase of 14.9 per cent in poultry population compared to 1972. In fowls alone, the increase has been 10.7 per cent during the five years, 1956-61. The number of fowls in 1972 was 124.14 million.

According to the Livestock Census of 1977, there were 160.9 million poultry birds. This showed an increase of 14.9 per cent over that of 1972. The number of fowls in 1977 was 149.3 million out of which 82 million were estimated to be improved stock.

Statewise, according to the 1977 census there were 21.61 million poultry in Andhra Pradesh, 10.42 million in Assam, 14.31 million in Bihar, 3.42 million in Gujarat, 1.38 million in Haryana, 969 million in Karnataka, 13.39 million in Kerala, 18.70 million in Maharashtra, 9.49 million in Orissa, 3.64 million in Punjab, 1.59 million in Rajasthan, 14.34 million in Tamil Nadu, 5.47 million in Uttar Pradesh and 15.49 million in West Bengal.

The annual egg production which was about 12.587 million in 1980-81 exceeded 1302 million in 78-79. It was estimated to be 13,500 million in 1982-83. This output is expected to increase to 16,000 million eggs before the end of 1984-85. The value of the annual output the poultry industry tripled from about Rs. 585 million in 1960 to Rs. 1,755 million in 1971.

The average laying capacity of the Indian hen is about 60 eggs per year. The yearly averages for the American breeds of White Leghorn and Rhode Island Red are 193 and 212 eggs respectively. The size of the egg of the Indian hen is also very small. On an average, it is a little over half of the exotic breeds like Rhode Island Red and Black Minorca.

Poultry keeping in India has so far remained largely a rural cottage enterprise. The common village hen, in spite of the scant care and attention and low productivity, is still considered a valuable member of the farmer's household.

IMPORTANT BREEDS OF POULTRY

A very large majority of the domestic fowls in India are non-descript. As a rule, the name *desi* is given to the indigenous fowls of any description. The number of improved fowls in India is very small. It is estimated at only 5·16 per cent of the total fowl population in the country.

The common *desi* hens show a great variation in their colour, size, and shape. As a rule, *desi* hens are small, slow growing and are poor layers of small-sized eggs. These are, however, ideal mothers, good sitters and excellent foragers. They are hardy and possess natural immunity against common diseases.

Among the *desi* breeds which are said to be more or less pure are the Aseel, Chittagong and Ghagus.

Aseel is the most important of all the indigenous breeds of fowls. It is well-known for its fighting qualities and is considered an ideal table bird. Its flesh is plentiful, delicious and has a characteristic pleasant flavour. These fowls are, however, poor layers, low in fecundity and slow in growth.

Aseel birds are found almost all over the country, but the best specimens are met with in parts of Andhra Pradesh near Hyderabad, and in Uttar Pradesh around Lucknow and Rampur districts.

Aseel is a large and noble-looking bird. There is no fixed or standard colour. The comb is very small and varies in type. The face is rather long, the wattles are rudimentary and almost imperceptible. The earlobes are small. The neck is scantily feathered. The plumage has little fluff and the feathers are tough. The tail is small and drooping to within a few centimetres of the ground. The standard weight is nearly 4·5 kilograms in cocks and 3·5 kilograms in hens.

Chittagong breed of fowls is named after the district in which it is largely bred. These birds grow fast and are considered ideal for table purposes. The flesh of the Chittagong fowl is very tasty.

There is no standard plumage colouration but the golden and light yellow are most popular. The comb is single and short. Earlobes and wattles are small and red in colour. The neck is long and the body is relatively short for its height. The legs are long and fairly thick. The shanks are yellow in colour and devoid of feathers. The plumage is sparse at the breast bone. The wings project at the shoulders and are carried high. The standard weight of the cock is approximately 4·5 kilograms and of the hen 2·5 to 4 kilograms.

Ghagus is a big and hardy breed. The birds are good for table.

The hen is a fair layer. It is a good sitter and efficient mother. The best specimens are seen with the nomads in parts of Andhra Pradesh and Karnataka State.

Ghagus has a small single or pea-shaped comb. The wattles and earlobes are small. The throat is loose and baggy. The legs are rather long, straight and strong. The usual plumage colouration is red, bay, brown, black and grey.

The exotic breeds of fowls which have been successfully acclimatised in India are the White Leghorn, Rhode Island Red and Black Minorca. The other breeds which have also been introduced are Plymouth Rock, Australorp, Light Sussex, New Hampshire, White Rock and White Cornish. These breeds are being widely used to upgrade the *desi* fowl.

White Leghorn is one of the most popular egg breeds of fowls all over the world. It is an excellent layer, but is not very much favoured for table purposes. In India, the White Leghorn has proved very suitable, especially in the drier parts of the country. It does not do well on heavy or wet soils and in hilly areas. The standard weight of a cock of this breed is 2·7 kilograms and of hen is 2 kilograms.

Rhode Island Red is one of the best all-round breeds of poultry. The quality and yield of flesh are good. It is an excellent layer. The eggs are brown-shelled and are large in size. Among the exotic breeds introduced in India, Rhode Island Red is by far the most popular. It is the hardiest of all breeds. It can withstand extreme climatic conditions in cold, wet and heavy rainfall regions. The standard weight of the cock is 3·8 kilograms and of hen 3 kilograms.

Black Minorca is the largest of all the Mediterranean breeds. It is noted for the superior size of its white eggs. In India, this breed is now losing its popularity because of decline in its production. The standard weight of cock is 3·6 kilograms and of hen 3 kilograms.

Plymouth Rock is a popular American breed. The birds are of good size, and have excellent quality of flesh. The hens are good layers. In India, the cocks of this breed have proved useful for upgrading the ordinary *desi* hens. The standard weight of the cock is 4·2 kilograms and of hen 3·2 kilograms.

Australorp breed has been greatly developed in Australia. It is considered a good all-round breed. In India, this breed is rapidly gaining popularity, especially in the wet and heavy rainfall regions. The standard weight of the cock is 3·8 kilograms and of hen 3 kilograms.

Light Sussex is primarily a meat breed but good laying strains have also been developed. The standard weight of the cock is 4 kilograms and of hen 3·2 kilograms.

New Hampshire is relatively a new breed developed in the United States. It has recently been introduced in India. It is known for its hardiness. The breed is a good producer of large brown shelled eggs. The standard weight of the cock is 3·8 kilograms and of hen 2·7 kilograms.

White Rock and *White Cornish* are rapidly gaining popularity in India. These breeds are especially noted for meat and are expected to play an important part in the production of broiler type chickens in the country. Crosses of these breeds are also very popular. The cock of the White Cornish breed has a standard weight of 3·6 kilograms and of hen 2·7 kilograms.

SELECTION OF BREED

Poultry keeping is said to be a business quickest to get in and one may be forced to get out equally quickly. Therefore, great care in the choice of the right type of breed, with due regard to local conditions and the needs of the market, is very essential for success. With the evolution of specialised breeds and strains of chickens for production of eggs and meat separately, it is of paramount importance that the right type of chickens are selected for breeding.

The potentialities of chickens, in respect of rate of growth and egg production within the same breed, vary vastly from each other. If it is intended to establish a poultry farm for the production of table eggs, it should be stocked with chickens possessing high laying qualities. Hens possessing inherited factors for high egg production will yield better results. On the other hand, hens lacking in these desirable characters will cause disappointment. Poor layers utilise most of their feed for purposes of maintaining the body. For commercial egg production, hybrid chicks obtained from matings between pre-selected strains of White Leghorn breed are generally considered more suitable.

If it is intended to produce birds for poultry meat industry, the selection should be limited to fast growing chickens. Such chickens will utilise their feed more efficiently for growth than slow growing ones. For commercial broiler production, hybrid chicks obtained by crossing selected males of White Cornish breed with selected hens of White Plymouth Rock or New Hampshire breeds should be preferred.

For commercial success, the most safe and economical course is to keep only one or at the most two selected breeds. Specialisation in a few breeds is better than to keep a large variety of breeds. By limiting the number of breeds, the problems of housing, breeding and rearing of birds are simplified.

Culling of Poultry

A great deal of success in poultry keeping depends not only on starting with good stock, but also maintaining its productive efficiency by constant culling. In a well managed flock, both the operations, selection and culling, are equally important. Culling is a continual operation on every poultry farm.

Poorly developed birds, with poor body-shape and fleshing, and those lacking in vigour and feather growth, should be culled as soon as they are observed. Abundance of vigour is indicated by bright prominent eyes, stout beak, broad head, bright yellow shanks, lustrous plumage and good fleshing. Poor layers should be culled early in the laying season in order to avoid their multiplication. Birds that have laid well for a short period but have stopped laying for some reason or other, should also be culled.

Systems of Keeping Poultry

There are two systems of keeping poultry generally practised in India, the semi-intensive system and the intensive system.

In the semi-intensive system, the chickens are let loose in the open yard during the day and are shut in a house or cage at night. In the villages, this system is considered most convenient. In the open yard, the birds have sufficient sunlight and fresh air, and free exercise. They can also have easy accesss to grasses and insects which are their natural food.

In order, however, to keep the birds comfortable and to get the maximum production from them, it is essential that sufficient area and roosting space should be provided. A fowl has no sweat glands to regulate its body temperature. In extreme weathers, the birds suffer much unless special care is taken to house them properly. The essentials of a good housing are comfort, safety, economy and convenience.

Under the semi-intensive system, an area of 230 square metres is required to keep 50 layers. A shed of suitable size should be provided in the yard. Feed hoppers, nest boxes, water utensils, and the cage for keeping the birds at night should be kept under the shed. To protect the birds from strong winds, curtains made of thatch or canvas cloth may be provided. Shady trees in the yard besides providing shade also act as windbreakers and help in keeping down the temperature in summer. The trees should not be allowed to grow tall and should be kept suitably pruned so that the top covering of wire netting is not damaged. All branches up to eight centimetres from the ground should be pruned so as to provide open space under the trees to avoid dampness and also facilitate cleaning of the place. Mulberry and citrus trees are considered suitable for the purpose. They form a nice shady umbrella during the summer months. During winter, these trees should be thinned to permit sufficient sunshine in the yard.

Sufficient number of nests should be provided in the yard for the hens to lay eggs. These nests should be kept under the shed, preferably on one side in a darkened corner, where laying hens are not disturbed. Laying of eggs in the open yard often results in their breakage or soiling specially during rainy weather.

A poultry farm should preferably be located on a medium soil, where some greens could also be grown. Heavy soils are not very suitable for a poultry farm. The soil should be free from dampness.

For keeping large-size flocks of poultry on a commercial basis, intensive system is considered more suitable. Under the intensive system, the hens are kept confined either on deep litter in a room or under a shed or in individual cages.

Deep or built-up litter system consists in keeping the hens on a floor covered with a thick layer of litter material in a specially constructed house. Built-up material does not mean creation of insanitary conditions for the birds. The litter material and the droppings are broken up by bacteria and other micro-organisms and a dry humus like material with a high absorptive power is produced which has got a sterilizing action. After a few months, bacterial action in the litter leads to the formation of animal protein factor, Riboflavin, other vitamins and trace elements. All these are picked up by the layers which help them to lay larger number of eggs and the hatchability of the eggs is also improved.

By adoption of this system, substantial saving is effected in the expenditure on land and labour. Wastage of feed and loss of birds due to predators are greatly reduced. Losses due to breakage or damage to eggs can also be kept at a low level. Eggs can be kept clean on dry litter and this helps to fetch better price for the eggs.

Material to be used for deep litter should be of organic origin, soft, dry, and free from dust and should have high absorptive power. It should neither be so finely powdered to become dusty nor so coarse and hard as to make its mixing with the droppings difficult. The materials commonly used for the purpose are rice husk, groundnut or cottonseed hulls, wheat *bhoosa*, finely broken corn cobs, rice straw, sugar-cane fibres, saw dust and wood shavings.

Before putting fresh material on the floor, all old litter and debris should be thoroughly cleaned. The floor, walls, internal fittings and equipment should be properly disinfected. A thick layer of 5 to 8 centimetres dry earth should be put on the floor and pressed firm, over which a 8 to 10 centimetres thick layer of suitable litter material should be spread. No fresh material should be added during the summer and rainy months except when wet patches are to be replaced. The litter should be started at least two months before the onset of rain and never during the wet weather. After the rainy season is over, add more litter material gradually in order to bring its thickness to 15 to 20 centimetres by the end of November. Maintain this thickness throughout the winter months and again reduce it to 8 to 10 centimetres during the summer and rainy months. The litter should never be allowed to get wet. Keeping the litter dry is essential for the success of the whole system. The litter should be often stirred to assure proper mixing of the droppings. This will also help in keeping the litter dry and prevent vermins from nesting in the litter.

The deep litter house should not be overcrowded with birds. Minimum floor space required per bird of light breeds is 28 square decimetres for a flock of 100 birds. In the case of heavy breeds, the floor space should be 32 square decimetres per bird.

The deep litter house should be provided with ample ventilation. It makes the birds comfortable and helps to improve their performance. The sides of the house should be kept open and covered with wire netting above the height of 60 to 75 centimetres from the floor. During severe cold weather, curtains of canvas or gunny cloth may be hung on the open sides in order to keep the birds warm.

In places like big cities, where space is very scarce, laying batteries are provided under the intensive system. Laying battery is a collection of cages used for housing laying hens. The cages are arranged in rows and tiers one above the other and are usually made of wire netting supported on metal frame. The laying hens are housed individually, one in each cage. They are kept confined in these cages throughout the day and night.

A convenient size of laying battery will be a unit of about seven cages constructed in a row in one single frame. The frame can be made of iron bars.

The floor of the cage is made of 2·5 centimetres mesh wire netting sufficiently thick and strong in order to support the weight of the hen. The floor is supported on the frame. In order to enable the egg to roll down from under the hen as soon as laid, the floor should have a downward slope of about 8 to 10 centimetres from rear to front where it should curve upwards to form a projection, about 6 to 8 centimetres high, for retaining the egg. Below this floor is placed a galvanised metal tray for receiving the droppings of the hen. This tray is supported on the frame.

When rows of cages are placed in tiers, one above the other, the dropping tray of a cage in the upper row constitutes a roof for the corresponding cage in the lower row.

The front side of the cage is mostly occupied by the feed and water vessels. The water trough is placed above the mash hopper. These vessels are supported on horizontal rods or curved projections of flat iron strips fixed to the frame. The rods should be spaced in such a manner as to give a clearance of about 6 to 8 centimetres between the wire mesh floor and the under surface of the mash hopper for providing a passage to the egg and 8 to 10 centimetres between the upper end of the mash hopper and the lower surface of the water vessel for enabling the hen to take feed easily. After providing a clearance of about 8 to 10 centimetres immediately above the water vessel for enabling the hen to drink water comfortably, the space above should be covered by fixing 1·3 centimetre mesh wire netting. The water troughs and mash hoppers can be provided one each for a cage or one for three to four cages collectively. Each cage should have an height of 45 centimetres, width 45 centimetres, and length 35 to 40 centimetres.

The water trough, mash hopper, the floor, and dropping tray should be removable to enable thorough cleaning frequently.

FEEDING THE FOWLS

In India the poultry is generally left to scratch its living. But for developing high egg or meat yielding capacity in the birds, it is essential to ensure their proper feeding and management. A hen has been described to be only an egg's way of making another egg.

The digestive system of chickens has its own peculiar needs, and the birds appear perpetually hungry, always looking around for something to eat. Feed is, however, the most expensive item. The cost of feed represents more than half the total expenditure on raising poultry. It is, therefore, obvious that careful study is needed in selecting feeds to meet the requirements of the purpose for which chickens are kept. A feed intended for promoting rapid growth differs in some respect from a diet meant for fattening the birds or for production of eggs.

For most economical production, poultry need a full feeding of a balanced ration. It is, necessary to combine a number of feedstuffs to prepare a balanced ration. It is not only important to supply all the nutrients, but more important is to supply them in just the right proportion. There would be a waste of carbohydrates when maize is fed alone and a waste of protein when only meat scraps are fed. There must, therefore, be a balance between the nutrients, so that the feed is used most efficiently for egg production and body growth of the birds.

Feeds given to the poultry consist chiefly of cereals, cereal by-products, other by-products of animal and plant origin and green feeds. Protein feeds, especially animal proteins are expensive. However, satisfactory egg production can only be obtained by feeding a combination of animal and vegetable proteins.

The modern method of feeding poultry is the all-mash diet which has come into wider use because of its simplicity. It is a complete ration and no additional grains need be fed with it.

A satisfactory mash for laying birds can be prepared by mixing by weight 30 parts of yellow maize or any other cereal or mixture of cereals, 20 parts rice polish, 10 parts barley or oats, 10 parts wheat bran, 15 parts decorticated groundnut cake, 4·5 parts corn gluten meal, 4 parts steamed fish meal, 3 parts steamed meat meal, 1 part steamed bone meal, 2 parts calcium powder and 0·5 part common salt. To 100 kilograms of this mash mixture, 4·4 grams of vitamin A, 0·5 gram vitamin B_2, 0·6 gram vitamin D_3, and 22 grams manganese sulphate should be added. In addition, the birds should be provided sufficient greens.

Baby chicks do not need food of any kind for about 36 hours after hatching. During this period, the contents of egg drawn by the chicks furnish the necessary food. For egg type growing chickens, a suitable ration can be made by mixing 28 parts yellow maize or any other cereal, 26 parts rice polish, 7 parts barley or oats, 7 parts wheat bran, 16 parts decorticated groundnut cake, 5 parts corn gluten meal, 5 parts steamed fish meal, 3 parts steamed meat meal, 1 part steamed bone meal, 1·5 parts calcium powder and 0·5 part common salt. To 100 kilograms of this mixture, 2·2 grams vitamin A, 0·5 gram vitamin B_2, 0·3 gram vitamin D_3, and 22 grams manganese sulphate should be added. Sufficient greens should be provided after one week of age.

For broiler birds, a suitable ration can be prepared by mixing 20 parts yellow maize or any other cereal, 28 parts rice polish, 7 parts barley or oats, 7 parts wheat bran, 20 parts decorticated groundnut cake, 5 parts corn gluten meal, 7 parts steamed fish meal, 3 parts steamed meat meal, 1 part steamed bone meal, 1·5 parts calcium powder and 0·5 part common salt. To 100 kilograms of this mixture, 2·2 grams of vitamin A, 0·5 gram vitamin B_2, 0·3 gram vitamin D_3, and 22 grams of manganese sulphate should be added. Abundance of greens should be provided after one week of age.

Chickens of heavy breeds need more quantity of feed. Birds of light breeds need less. On an average, about 56 kilograms of feed mixture is required daily for 100 chickens up to four weeks age and 900 kilograms at the age of about 20 to 24 weeks. For feeding poultry, a slightly granular mash should be preferred rather than a fine mash like flour.

WATER REQUIREMENTS OF CHICKENS

To keep the birds healthy and for efficient production, enough water should be provided at all times. Water makes up a large proportion, approximately 60 per cent of the birds' body weight and nearly two-third of that of an egg. Chickens can live longer without food than without water. Poultry needs to have water available constantly since they drink only small quantities at one time. Chickens must drink every 15 to 20 minutes.

Approximate quantities of water required daily for 100 chicks up to four weeks of age are six to seven litres. Hundred chicks from four to eight weeks old require 9 to 12 litres, and 100 laying birds about 20 to 25 litres of water daily.

HATCHING OF EGGS

In India, poultry birds are generally kept in small units. The eggs, therefore, are usually hatched under the hens. The brooding hen sits on the eggs for 20-21 days and supplies the necessary heat for developing embryo. After this period, the chick inside the egg breaks its outer shell with the tip of its beak and comes out.

For successful hatching, it is essential that the eggs for hatching should be collected a week or 10 days after the cock is allowed to run with the hens. Fertile eggs are laid generally for more than a week after the cock has been taken away from the breeding pen. No eggs should be set for hatching which are older than five days in the hot season, and ten days in the cold weather. Soiled eggs should not be washed before setting, as washing opens the pores in the shell and this affects the hatching adversely. Highly soiled eggs should not be used for hatching.

The hen selected for hatching should be healthy, strong and sufficiently broody. The hen should be made to sit in a soft nest made of fine hay, straw or dry leaves placed in a quiet dark corner. The nest should be placed near the ground so that the hen can enter and come out without difficulty. During hatching, the hen should not be unnecessarily disturbed. A good-sized hen can hatch ten to fifteen eggs at a time. The hen should be removed from the eggs gently every day for some time to take feed and water. The sitting bird should receive water twice daily and adequate amounts of whole grain and limestone grit. Sloppy foods should be avoided as they tend to produce loose droppings and consequent soiling of the eggs.

More recently, artificial hatching by incubators has become popular in India. Artificial hatching is economical where large number of eggs are required to be hatched. It reduces labour and facilitates hatching as and when required. Incubators range in size from small machines holding 25 eggs to mammoth machines holding many thousand eggs. For best results, incubator should be placed in a separate room. The room should be well-ventilated. The windows in the room should not be exposed to the direct rays of the sun.

Normally, a temperature ranging from 38·3 to 39·4 degrees C (101 to 103 degrees F) is maintained in small incubators. In large mechanically operated incubators, heating and other operations such as the turning of eggs, are controlled by electric devices.

An adequate amount of humidity inside the machine is necessary to prevent excessive loss of moisture from the eggs. The optimum humidity ranges between 60 and 65 per cent. In dry weather, humidity can be raised by placing the incubator above special trays filled with water or wet sand.

The incubator should not be opened after the eighteenth day until the hatching is practically completed. After the hatching is fully over, the chicks are removed to the brooders.

Brooding of Chicks

Like incubation of eggs, the chicks may be reared under a hen or artificially under a brooder, commonly known as foster mother. Brooding period is from day old to eight weeks and is by far the most delicate part of the chicken's life.

The best system of natural brooding is to confine the hen in a coop and allow the chicks into a small separate run which is moved daily along with the coop on to a fresh site. *Desi* hens, as a rule, are ideal mothers. An average-sized hen can conveniently brood 10 to 15 chicks.

Artificial brooding has, however, many advantages over natural brooding. In artificial brooding, the required number of chicks can be reared at any time of the year. Mortality due to diseases, predators and parasites can be more effectively controlled.

In artificial brooding, a special type of equipment called brooder is used. It is essential to provide heat at about 26·7 to 32·2 degrees C (80 to 90 degrees F) to the chicks till they grow feathers. In nature, the mother hen supplies the heat to the chicks by means of her own body and feathers. In artificial brooding, the required heat is provided by means of kerosene lamps, electricity or batteries. Excessive heat, however, would devitalise the chickens by inducing quick feather growth at the cost of bones.

GENERAL MANAGEMENT

Till the age of about six to eight weeks, the sex signs in chickens are not clearly indicated. At about eight weeks, the comb and wattles in males are well developed, whereas in the females they are much less conspicuous. The females, as a rule, are usually better feathered, especially along the back, than the males. Recently, it has been made possible to do sexing of one-day old chicks with fairly good accuracy by the Japanese vent method. A considerable amount of training and experience is, however, necessary before one can practise this method with some degree of accuracy. Lately, chick sexing instruments have been evolved which enable sex distinction to be made in day-old chicks. One of the immediate benefits of sexing day-old chicks is that the male and female chicks can be selected very early in life and disposed of according to the commercial requirements.

The egg producing breeds normally start laying eggs at the age of 5½ to 6 months, while the birds of heavier breeds will not lay before the age of seven to eight months. Hens that have laid eggs for more than one year, usually show a marked decrease in egg production. It is, therefore, advisable to dispose of the hens each year and start with a new batch of pullets.

During the short day-light hours of winter months, when there is less than 13 hours of daylight, the use of artificial lights have been found to greatly stimulate egg production. Light stimulates birds to eat more feed and to lay more eggs.

For breeding, the approximate number of females per male bird, under average conditions, is ten or twelve. Young chicks and adult birds should not be reared together. Debeaking is commonly practised when chicks are 10 to 14 days of age to stop excessive pecking, particularly if the birds are kept in confinement.

It is commonly believed that the presence of a male bird is necessary for the hen to lay eggs. This is, however, not correct.

Hens lay without the presence of the cock but such eggs are infertile and are popularly called *vegetarian eggs*. These eggs do not hatch but have better keeping quality. Wherever it is possible to keep the sexes separately, particularly during summer months, when eggs are not required for hatching, this practice should be encouraged.

THE QUALITY OF EGGS

As a rule, all eggs are of good quality when newly laid. The egg, when newly laid, has no air space on the large end but as it cools down, air space develops. The flavour of eggs depends to some extent on the nature of the feed. Green foods and yellow maize tend to give good coloured yolk. As a rule, good coloured yolk is rich in vitamins and is superior to pale yolk. The content of newly laid eggs are almost invariably free from infection, but certain hens occasionally may lay infected eggs.

The colour of the egg-shell has no relationship with egg quality. The colour of the shell is determined by the breed. Normally, the Leghorn hens lay white eggs, while the colour of the Rhode Island Red eggs is brown.

The size of eggs varies considerably between different breeds, but may also vary within the birds of the same breed. As a general rule, the size of an egg is proportionate to that of the bird. Poorly-fed birds do not give good egg-size. Poor feeding may also result in eggs with poor shell quality.

To preserve good quality, the eggs should be gathered from the nests as often as possible and should be kept in a cool place. The eggs kept submerged in lime-water keep longer. Similarly, eggs kept in water-glass keep fairly well. Eggs which are to be preserved in water-glass and lime-water, should not be washed. Eggs preserved either by water-glass or lime-water will keep in excellent condition for several months, provided fresh, clean and infertile eggs are used. Defertilisation of eggs by heating the eggs in water at 54·4 degrees C (130 degrees F) for 15 minutes also helps in improving their keeping quality. Defertilised eggs keep better and longer. In India, the most common cause of egg spoilage is the development of embryo in fertile eggs, especially during summer months.

NUTRITIVE VALUE OF EGGS

Eggs are one of the best protective foods available to man in the form as originally packed by nature itself. Besides an excellent source of phosphorus, iron, lipids, phospholipids and vitamins A, B and D, eggs are remarkably rich in proteins of high nutritive value. Proteins form nearly one-sixth of the whole egg. The distribution of proteins and other major nutrients varies in yolk and white portions. The yolk contains about 16 per cent protein and the white about 10 per cent protein of their own weights.

Because of the abundance and the ideal proportions of essential amino-acids, the proteins of egg-white and yolk are of very high nutritive value. When whole egg is consumed, the individual proteins supplement one another very satisfactorily.

From nutritional point of view, many of the domestic methods of preparing eggs are wasteful, as they particularly involve loss of protein content of eggs. There is no protein loss in boiled eggs, while it is 3 per cent in preparing omelettes, 9 per cent in fried and 14 per cent in scrambled eggs. The boiled eggs have also better digestibility as compared to raw eggs.

COMMON VICES IN CHICKENS

Due to lack of proper management, a number of vices often occur in the growing birds. Cannibalism is the most common of them. Young chicks get into the habit of pecking at toes, combs, vents and feathers of other birds. This vice is more common in the birds which are kept under conditions of over-crowding, unbalanced diet and lack of exercise. De-tipping of the beak of the affected bird is generally practised. De-tipped birds can take food and water but not peck at others. Anti-peck devices have also been developed.

Feather picking is another common vice among poultry birds. Once a bird gets into this habit, it is difficult to prevent him from pecking his own feathers or of other birds. The main causes responsible for this vice are faulty diet, close confinement, or mites which cause irritation. The offenders should be removed from the flock.

Egg-eating is one of the hardest vices to break. The birds get into the habit of breaking the eggs laid by them and eating them. To prevent this, plenty of nests should be provided. The eggs should be gathered more frequently. The birds should be given plenty of greens and limestone grit or oyster shells. More space should be provided to the birds. The offenders should be removed from the flock.

In a flock, certain cocks develop into the habit of showing special affinity towards certain hens and mate with them only. This results into production of infertile eggs by other hens. This fault can be prevented by changing the cocks at short intervals.

COMMON DISEASES OF FOWLS

In poultry, disease control is of paramount importance. Disease prevention in fowls is a far more important measure than disease cure. Poultry should always be kept under strict hygienic conditions. All newly arrived birds should be kept separately for at least two weeks. The young stock should not be allowed to mix with the adult birds. Equipment, feeding and watering utensils should be thoroughly cleaned every day. Dampness and overcrowding should always be avoided.

The general symptoms in a sick bird are loss of appetite, dullness, debility, rise in temperature, and comb and wattles become pale. The bird stands aloof, generally in crouching position and shows signs of inactivity.

The normal rectal temperature of a healthy chicken varies from 40·5 to 43 degrees C (105 to 109·4 degrees F), the average being 42 degrees C (107·6 degrees F). The normal respiration rate is 15 to 30 per minute. The average rate of heart beat is 300 per minute.

Poultry are particularly liable to worm infestation. Worms retard the growth of birds and reduce their egg laying capacity. External parasites such as lice, ticks, mites and fleas cause great annoyance to poultry birds and affect their productive efficiency. The fowl-tick is the worst enemy of the poultry. Ticks breed in the crevices and fissures of timber and brick work. Birds should be regularly examined for internal worms and external parasites.

Some of the most common fowl diseases met with in India are Ranikhet, Coccidiosis, Fowl-pox and Tick-fever.

Ranikhet is the greatest scourge of poultry in India. It is a highly infectious and fatal disease. About 80 to 100 per cent affected birds die. The most characteristic symptoms of the disease are loss of appetite, droopiness, sleepiness, ruffled feathers and debility. The bird gasps for air. Breathing is difficult. Green diarrhoea sets in. The bird shows signs of progressive paralysis.

To prevent this disease, all young birds should be vaccinated as soon as they are six weeks old. The sick birds should be immediately isolated and destroyed.

Coccidiosis is a common disease of young birds, usually between the age of 2 and 12 weeks. Mortality rate is very high. The general symptoms are blood-stained diarrhoea, listlessness and ruffled appearance. The affected birds huddle together in a corner.

Chicks should be kept in dry and well-ventilated houses. The premises should be kept clean and sanitary.

Fowl-pox is a highly contagious disease. It is more common in summer months. It affects birds of all ages, but young chickens are more susceptible than the adults. Mortality in young birds is very high. The general symptoms are wart-like nodules on the comb and wattles and appearance of greyish spots or blisters on the skin. Sometimes the eyes and nose are covered by a yellowish cheesy discharge.

All young chicks above four weeks of age should be vaccinated against fowl-pox as a routine preventive measure. In an actual outbreak of the disease, all ailing birds should be isolated and destroyed.

Tick-fever is one of the commonest and highly fatal of poultry diseases. The disease is mainly spread by the bites of ticks. The usual symptoms are loss of appetite and increased thirst, crouching appearance, rise in temperature to about 43·3 degrees C (110 degrees F) and sudden drop in temperature to sub-normal, 24 to 48 hours before death. The comb and wattles become pale and there is a profuse discharge of loose greenish droppings. Progressive paralysis of legs and wings occurs. In acute cases, the bird dies in convulsions.

Prevention of this disease consists in keeping the poultry houses and runs free from ticks. Tick-proof perches should be provided. Strict sanitary precautions should be observed. Affected birds should be treated promptly.

DUCKS

The second most important kind of poultry raised in India is ducks. Ducks thrive well on any soil, preferably where semi-aquatic conditions prevail.

India produces 401·4 million duck eggs every year. This is nearly 16 per cent of the total egg production in the country. A duck lays 30 to 40 eggs more than a hen in a year. Duck eggs are heavier than the hen eggs, and weigh from 70 to 84 grams each. Ducks are more hardy than fowl and are practically free from diseases. Generally, they do not require as much attention as fowls.

There were 9.01 million ducks in India, in 1972. These were 0.68 million less than the number in 1966. There were 9.69 million ducks in 1966 which showed further increase of 44.6 per cent over that of 1961. The largest number of ducks 4,425 was found in West Bengal, followed by Assam 2,873, Tamil Nadu 654, Andhra Pradesh 465, Kerala 430, Bihar 564 and Orissa 212.

IMPORTANT BREEDS OF DUCKS

Among ducks, there are three main types of breeds, namely, meat, egg-laying and ornamental. For the most part, ducks raised in India are of egg-laying type.

Important breeds of Indian ducks are Sylhet Mete and

Nageswari. The Indian Runner and the Khaki Campbell are the improved breeds which have thrived well under Indian conditions.

Sylhet Mete is the ordinary duck, commonly found in the villages in Eastern India. It is light brown in colour with black tips on feathers and yellow beak. When in full feather, the duck has a blue neck and head. The average yield of eggs varies from 80 to 150 per duck. The colour of the egg is white. The average weight of the egg is about 56 grams. An adult bird weighs about 1·8 kilograms.

Nageswari ducks are mostly found in the districts of Cachar and Sylhet in the Surma Valley of Assam and in East Bengal. The back and most of the body of these birds are black, while the breast and throat are white in colour. . Under farm conditions, a duck of this type lays 80 to 150 eggs a year. The colour of the egg is pale blue. The average weight of egg is about 56 grams. An adult bird weighs nearly two kilograms.

The birds of *Indian Runner* breed are found in some of the States in India, but they are bred pure in a very few places. The birds are white in colour. They carry their body in a noticeable upright position. The Indian Runner is widely used for crossing with the heavier breeds to improve their laying capacity. The average weight of an egg, which is white in colour, is over 56 grams.

Khaki Campbell is the most popular breed, generally bred for profitable egg production in India. The colour of the drake is black at the neck and back. The duck is of Khaki colour which develops into grey when one year old. The ducks start laying eggs at about six months' age. The maximum number of eggs are laid during the second year. The birds are generally sold when four years old. The eggs are of white colour. The average weight of an egg is nearly 70 grams.

GENERAL MANAGEMENT OF DUCKS

After the ducks are feathered, they are ready to range for themselves on tanks and lakes, where grass, snails, and other insects make up a considerable portion of their food. Ducks are voracious feeders and will eat anything they can find. For one kilogram of live weight gained by the birds, about four kilograms of feed is consumed. The growing and laying birds should be fed good ration. Care should be taken that the breeding birds do not get fat. A suitably balanced all-mash ration for ducklings and ducks can be prepared by mixing 35 parts ground maize or any other cereal, 20 parts wheat or rice bran, 30 parts groundnut cake, 5 parts fish meal, 4 parts ground limestone or oyster shell, 5 parts dried greens, 0·5 part salt and 0·5 part shark liver oil. The ration should be given as wet mash. Ducks drink lot of water along with the mash. Clean fresh water should always be provided to them.

For breeding, one drake is allowed for every five or six ducks. Ducks usually lay their eggs at night and in the morning. Eggs of the common duck take 28 days to hatch. In the case of eggs of Muscovy duck, the incubation period is 35 days. Usually they are incubated the same way as hen eggs. The drake can be distinguished from the duck by the curly feather in his tail. The drake has an inaudible thin voice. The voice of the duck is very full.

The general management of ducks is similar to that as for the chickens. Ducks prefer quietness and must be handled gently. Young ducklings need not have running water until they are six to eight weeks old. They are quite safe at five weeks to go into grass run and range house.

The ducks should be provided suitable house with run, preferably on the banks of the tanks or any water place. Any available shed or a part of the poultry house may be utilised for the purpose. The roof of the house may be made of any kind, but the floor should be *pucca*, preferably cemented. Chickens and ducks should not be kept together. A house with a length of 3·6 metres, breadth 2·3 metres and height 1·8 metres will be enough to accommodate 24 ducks.

In ducks, the normal temperature varies from 41·5 to 42·5 degrees C (106·7 to 108·5 degrees F), average being 42 degrees C (107·6 degrees F). Respiration per minute varies from 15 to 48. The normal rate of heart beat is 120 to 160 per minute.

Mature ducks are usually free from diseases and seldom suffer from Ranikhet disease. The transmissible diseases of ducks and ducklings are duck cholera, duck virus hepatitis, keel disease, and fowl plague. Ducks are remarkably free from lice and other insect pests.

GEESE

Most geese, found in India, are white in colour and are, more or less, related to the Chinese geese. Brown-backed geese are also found in some parts of the country. When white and brown backed geese are interbred, they do not inherit any mixed colouring, and the progeny shows only one type.

The brown-backed goose has a white belly and brown wings, back and head. The breast is light brown and the throat is white. The white goose is white all over the body.

The important breeds of geese are Emden, English White, Roman, Toulouse, White Chinese, Farm Chinese, English Grey and Indian goose. The heaviest breed is the Emden and the lightest is the Indian goose.

Geese are raised mainly for meat production. Geese are also very good watch birds. The live weight of a common gander and goose is 3·5 and 3 kilograms respectively. Purebred goose may have a weight of 4 kilograms at 12 weeks, and 6 kilograms at 24 weeks. For table purposes, these birds are considered to be excellent, especially when grass fed. Geese lay two clutches of eggs a year of ten to twenty, each generally during winter months of December-January. Geese lay eggs between eight to ten in the morning on alternate days. The average weight of an egg is nearly 128 grams.

General Management of Geese

The young goose, when a few weeks old, is hardy enough to find its feed such as grass, snails and insects. Geese are good foragers. On free range with plenty of grass, geese will devour huge quantities and require no other type of food. They will keep a lawn clipped close. They can be largely reared on grass. But for better growth and production, they need grain feed. The feed should be fed as wet mash and should consist of greens, cereals, bran and limestone grit. For better returns, geese should be marketed as soon as they reach maturity, at about nine to twelve months.

The common Indian goose can be improved by crossing with purebred Emden or Toulouse gander, and then mating the geese of this cross with purebred ganders of these breeds for three or four generations. Normally, one male is run with four to six females. Eggs of small breeds of goose take 28 days to hatch and of large breeds 34 to 35 days or more. An average sized goose can take about fifteen eggs for hatching.

A flock of ten geese would need a floor space of nine square metres.

Geese are not susceptible to common poultry diseases and do not need much attention. In healthy geese, the normal temperature is 42·0 degrees C (107·6 degrees F). Respiration per minute is 20 to 25. The rate of heart beat is 110 per minute.

TURKEYS

In India, turkeys have gained some popularity during recent years. They are mainly reared for meat. Turkey production is possible under a wide range of climatic conditions. They grow well in very cold as well as very hot climates. Turkey meat production is akin to the broiler trade, the difference being that turkeys are slow maturing and need more time to reach good body size for market purposes.

In the U.S.A., the production of turkeys has increased rapidly since 1920. During 1920 there were about 4 million turkeys on farms. By 1930 there were 17 million, and by 1940 the number had increased to 33 million. By 1972 approximately 129 million birds were produced.

Turkey is no longer just a Thanks giving and holiday treat. It is served the year round and competes with mutton, pork and chicken at the consumer markets.

Most of the turkeys ordinarily seen in India are of Broad

Breasted Bronze breed. The other important breeds are Norfolks and the Cambridge. British White (White Holland) and Beltsville White are popular breeds in Western countries.

Broad Breasted Bronze is the heaviest of all varieties and is most popular in the United States of America. Its plumage is black underneath with a surface of iridescent green bronzing. The average egg production is 75 eggs in the first year. The eggs weigh nearly 85 grams each. The colour of the egg is white mottled with brown. The body weight is 11 kilograms for the young tom and 7 kilograms for the turkey hen of this breed. This breed puts on more fat than other varieties. It has low fertility and hatchability.

GENERAL MANAGEMENT OF TURKEY

The reproductive ability of the turkey is relatively low, particularly with heavier breeds. Hatchability is also low in heavier varieties. The female commences laying eggs about the middle of March. Turkey hens generally lay about 70 eggs during their first laying season. When the turkey females reach eight to nine months of age, artificial lights are used to stimulate egg production in them.

Artificial insemination is usually practised in turkey breeding. During the breeding season, the average fertility with artificial insemination runs between 70 and 80 per cent. Turkey eggs take 28 days to hatch. In the Broad Breasted Bronze breed, eggs weighing over 80 grams are selected for hatching.

Turkey matures when three years old. Normally, one cock is allowed to run with 5 hens. Turkeys are usually bred for three or four years.

Turkey poults are similar to chickens in their brooding and management requirements. For maximum profit, turkeys should be marketed by the time they are 20 to 26 weeks of age. Fat grade in the turkey is judged by the thickness of the fold of breast skin.

As far as possible, turkeys should be allowed perfect liberty in he fields and orchards. They should, in addition, be given feed

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As far as possible, turkeys should be allowed perfect liberty in he fields and orchards. They should, in addition, be given feed consisting of wheat bran, ground paddy, and finely chopped boiled vegetables, in the morning and evening. Generally, the feeding practices are about the same as for chickens. Lettuce, onions, and minced meat are much liked by young turkeys.

A large shed enclosed with wire netting, with wide perches, about one metre from the ground, will provide all the protection necessary for adult birds. Turkey chicks should preferably be reared on wire-netted flooring.

Turkeys are hardy birds but they are subject to many of the diseases to which domestic fowls are susceptible. Black-head is a serious disease of the turkeys. Lice is another menace in turkey raising. As in chickens, great care is needed to keep the premises in sanitary and hygienic conditions. The normal temperature in turkeys is 42 degrees C (107·6 degrees F).

GUINEA FOWLS

Guinea fowls can play an important part in the poultry business. They are raised primarily for meat. They, however, prefer to remain in a semi-wild environment. They roam about widely in search of food. They can be fed and managed in a manner similar to chickens.

Generally, three to four females are allowed per male. Guinea fowl eggs take 28 days to hatch. The normal temperature of Guinea fowl is 42 degrees C (107·6 degrees F).

BIBLIOGRAPHY

Benedict, F.G., *The Physiology of the Elephant*, Carnegie Institute, Washington, 1936.

Bhatia, S.S., *Goat—the Poor Man's Cow*, Department of Animal Husbandry and Fisheries, Uttar Pradesh, Lucknow, 1954.

Bhatia, S. S., *Feeding Goats for Milk Production*, Directorate of Extension, Ministry of Food and Agriculture, New Delhi, Farm Bulletin No. 52, 1959.

Evans, G.H., *Elephants and Their Diseases*, Superintendent, Government Printing, Burma, Rangoon, 1910.

F.A. Bulletin., Pub. by Food and Agriculture Organisation of United Nations, Rome.

Indian Agriculture in Brief Directorate of Economic & Statistics, Ministry of Agriculture. 9th Edition.

Indian Council of Agricultural Research, New Delhi, *Human Nutrition Vis-a-Vis Animal Nutrition in India*, 1954.

Indian Council of Agricultural Research, New Delhi, *Handbook of Animal Husbandry*, 1962.

Indian Council of Agricultural Research, New Delhi, *Brief Survey of Some of the Important Breeds of Cattle in India*, Miscellaneous Bulletin No. 46, 1960.

Juneja, G. C., *Horse Breeding*, Animal Husbandry Department, Uttar Pradesh, Lucknow, 1957.

Kaura, R. L., *Swine Husbandry and Piggery Products*, Indian Council of Agricultural Research, New Delhi, Review Series No. 27, 1958.

Kaura, R. L., *Cattle Development in the Uttar Pradesh*, Department of Animal Husbandry, Uttar Pradesh, Lucknow, 1950.

Kaura, R. L., *Indian Breeds of Livestock (including Pakistan)*, Prem Publisher, Lucknow, 1961.

KHOT, S. S., *Sheep and Wool in India*, Indian Council of Agricultural Research, New Delhi, Farm Bulletin No. 16, 1957.

KUMAR, L. S. S., etc., *Agriculture in India, Vol. III*, Asia Publishing House, Bombay, 1963.

LEESE, A. S., *A Treatise on the One Humped Camel in Health and Disease*, Haynes and Sons, Maiden Lane, Stamford, Lincolnshire, 1943.

LYDEKKER, R., *The Great and Small Game of India, Burma and Tibet*, Rowland Ward Ltd., London, 1900.

MILLER, W. C., (Editor), *Black's Veterinary Dictionary*, Adam and Charles Black Ltd., London, 1962.

NAIDU, P. M. N., *Poultry Keeping in India*, Indian Council of Agricultural Research, New Delhi, 1959.

NANDA, P. N., *Camels and Their Management*, Indian Council of Agricultural Research, New Delhi, Review Series No. 16, 1957.

RANDHAWA, M. S., *Agriculture and Animal Husbandry in India*, Indian Council of Agricultural Research, New Delhi, 1962.

SEN, K. C., and RAY, S. N., *Nutritive Values of Indian Cattle Feeds and the Feeding of Animals*, Indian Council of Agricultural Research, New Delhi, 1964.

SINGH, HARBANS, AND EARL, N. MOORE, *Livestock and Poultry Production*, Prentice Hall of India, Third Edition, New Delhi, 1978.

SINGH, HARBANS, *Indian Breeds of Cattle and Buffaloes and their Availability*, Directorate of Extension, Ministry of Food and Agriculture, New Delhi, 1966.

SINGH, HARBANS, *Cattle Keeping in India*, Central Council of Gosamvardhana, New Delhi, 1966.

SINGH, HARBANS, *A Handbook of Animal Husbandry for Extension Workers*, Ministry of Food and Agriculture, Government of India, New Delhi, 1969.

SINGH, HARBANS, *How to Raise Pigs for Profit*, Directorate of Extension, Ministry of Food and Agriculture, Government of India, New Delhi, 1964.

SINGH, HARBANS, *Milk and Milk Products*, Ministry of Food and Agriculture, Government of India, New Delhi, 1968.

SINGH, HARBANS, *A Survey of the Breeds of Cattle in India*, Lahore Book Shop, Ludhiana, 1936.

SINGH, HARBANS, *The Key Village Scheme in India*, Directorate of Extension, Ministry of Food and Agriculture, Government of India, New Delhi, 1961.

SINGH, HARBANS and IYER, S.G., *Common Diseases of Farm Animals and Poultry*, Directorate of Extension, Ministry of Food and Agriculture, Government of India, New Delhi, 1961.

SINGH, HARBANS and PARNERKAR, Y. M., *Basic Facts About Cattle Wealth and Allied Matters*, Central Council of Gosamvardhana, New Delhi, 1966.

SRIVASTAVA, J. S. and KHERA, R. C., *Textbook of Animal Husbandry*, Indian Council of Agricultural Research, New Delhi, 1960.

WARNER, J. N., *Dairying in India*, MacMillan Co., Ltd., Calcutta, 1951.

WRIGHT, NORMAN C., *Report on the Development of the Cattle and Dairy Industries in India*, Manager of Publications, Government of India, New Delhi, 1937.

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India has a large livestock population of 343.86 millions, comprising buffaloes, sheep, goats, pigs, horses, mules, donkeys and camels. There are in addition, 115.1 million poultry birds. In spite of their enormous number, however, livestock in India make very meagre contribution to the national economy—about 7.2 per cent of the total national income. Various factors like adverse climatic and environmental conditions, poor genetic potential of our breeds, shortage of feeds, etc. are responsible for this. The author analyses these problems in the light of latest data and also advanced procedures adopted in other countries, and suggests ways to achieve optimum utilisation of our livestock (and poultry) resources.

Shri Harbans Singh was formerly Animal Husbandry Specialist in the Ministry of Food and Agriculture, Government of India. A man of wide experience in his field, he is the author of *Milk and Milk Products*, *A Survey of the Breeds of Cattle in India*, *Livestock and Poultry Production*, *Key Village Plan for Cattle Development*, *A Digest of Common Animal Diseases in India*, and other similar works.

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